

Project number: 5742
Funding source: Teagasc

Date: Dec, 2011
Project dates: Oct 2007 - Dec 2011

Examination of the effect of weaning stress on physiological, immune and behavioural responses of beef calves



Key external stakeholders:

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

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.
- The findings of this project, substantiated and contributed to the “Animal Welfare, Recording and Breeding Scheme for Suckler Herds” as outlined by the Department of Agriculture, Food and the Marine. <http://www.agriculture.gov.ie/farmerschemespayments/sucklerherdswelfarescheme2008-2012/awrbs2010/>.

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.

Opportunity / Benefit:

The results of this research have

- Demonstrated that, as a result of transitory alterations in the immune system, abrupt weaning can increase susceptibility to disease in beef calves.
- 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.

Collaborating Institutions:

NUI (Maynooth)

Teagasc project team: Dr. Bernadette Earley
Dr. Mark McGee
Dr. Eilish Lynch
Dr. Aran O’Loughlin

External collaborators: Dr. Sean Doyle (NUI Maynooth)

1. Project background:

Within seasonal, grassland-based suckler beef production systems in Ireland, calves are generally spring-born and reared with their dam at pasture for approximately 8 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, e.g. 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. There is little published information on the effects of weaning and associated practices on the physiological and immunological responses in the beef calf. This project set about addressing the knowledge gaps.

2. Questions addressed by the project:

- 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 (i.e. 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 (i.e. offering supplementary concentrates) alleviate the stress response in weaned beef calves?

3. The experimental studies:

1. Characterised the physiological and immunological response in beef calves and cows to abrupt weaning and subsequent housing.
2. Studied 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.
3. 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.
4. 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.

4. Main results:

- Using conventional blood indicators of stress (i.e physiological, haematological and immunological variables), abrupt weaning (vs. not weaning) was shown to be stressful to the suckler calf with alterations in immune function and hormonal mediators of stress still evident 7 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 (i.e. real-time (RT)-qPCR), the expression of a number of key genes regulating immune function in the calf are impaired up to 7 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 (i.e. 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.

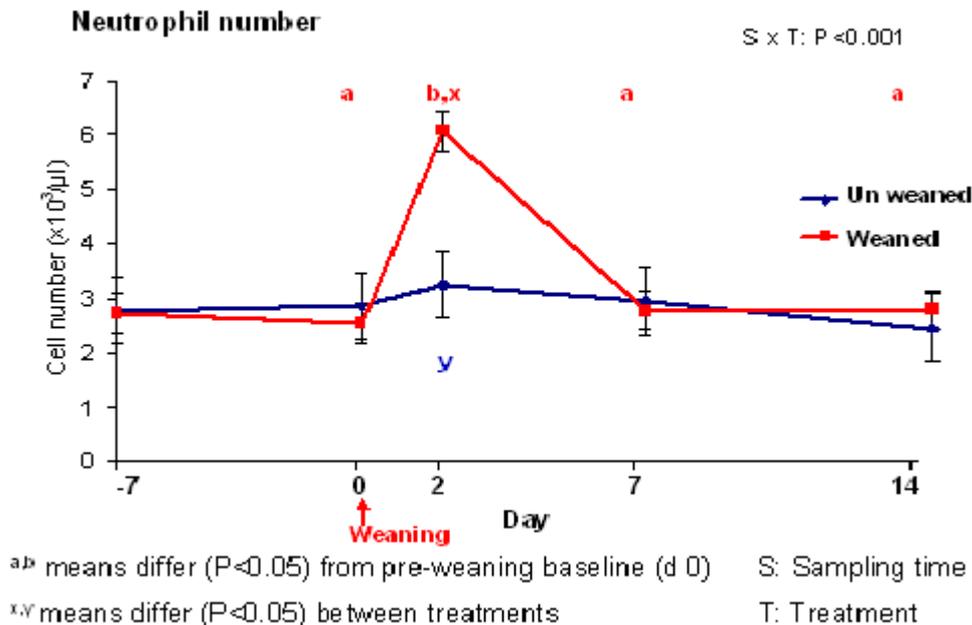


Figure 1: Neutrophil distribution in Weaned and Un-weaned beef calves. (A neutrophil is an immune blood cell that increases in response to stress).

5. Opportunity/Benefit:

The results of this research have; 1), demonstrated that, due to transitory alterations in the immune system, abrupt weaning can increase susceptibility to disease in beef calves; and 2), 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.

6. Dissemination:

Main publications:

Lynch, E.M., Earley, B., McGee, M., Doyle, S. (2010) Effect of abrupt weaning at housing on leukocyte distribution, functional activity of neutrophils, and acute phase protein response of beef calves. *BMC Veterinary Research* 6:39 doi:10.1186/1746-6148-6-39.

Lynch, E.M., McGee, M., Doyle, S., Earley, B. (2012) Effect of pre-weaning concentrate supplementation on the peripheral distribution of leukocytes, functional activity of neutrophils, the acute phase protein response and the metabolic responses in abruptly weaned beef calves. *BMC Veterinary Research* 8:1.

O'Loughlin, A., McGee, M., Waters, S.M., Doyle, S., Earley, B. (2011) Examination of the bovine leukocyte environment using immunogenetic biomarkers to assess immunocompetence following exposure to weaning stress. *BMC Veterinary Research* 7:45.

Popular publications:

Earley, B., McGee, M., Lynch, E. (2011) Management of suckler beef calves at weaning. *Irish Farmers Monthly* 40-41.

Compiled by: Bernadette Earley and Mark McGee