Effect of abrupt weaning at housing on welfare biomarkers in beef suckler calves

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**Weaning**

- **Abrupt weaning is a multifactorial stressor**
  - Psychological
    - Complete separation from dam
    - Adaptation to new environment
    - Social reorganisation
  - Nutritional
    - Adaptation from liquid diet to novel solid diet
  - Physical
    - Environment e.g. housing and transportation

Stress has a negative impact on disease susceptibility and welfare of livestock

(Blecha et al., 1984; Griffin, 1989; von Borell, 2001; Hickey et al., 2003, Arthington et al., 2005, 2008, Blanco et al., 2009)
Weaning stress response

- Abrupt weaning is a stressful event that can elicit an acute stress response that alters physiological responses and can impair immune response.

  - Mediated by the action of stress hormones (cortisol and noradrenaline) on leukocytes.

  - Involves activation of the hypothalamic pituitary adrenal (HPA) axis and other integrated axes.

  - HPA activation is associated with reduced immunity.

(Lefcourt and Elsasser, 1995; Hickey et al., 2003, Arthington et al., 2005; 2008; Blanco et al., 2009)
Stress

Hypothalamus

Anterior Pituitary

CRH

ACTH

Adrenal Cortex

Glucocorticoids
  • Cortisol
  • DHEA

Target cells:
  • Leukocytes
  • Neutrophils
  • Lymphocytes

Immune response

Disease susceptibility

BRD

Resolution of threat

Disease susceptibility

-
Gaps in the knowledge

Further investigation on the effects of pre- and post-weaning management on the weaning stress response in beef calves

Further investigation into the mechanisms of immune suppression post-weaning
  - Lymphocyte immunophenotypes
  - Neutrophil functional activity

Effect of weaning on the physiological and immunological responses in beef cows has not been investigated
Objectives

To examine the effect of **abrupt weaning at housing** on the peripheral leukocyte and lymphocyte subset distribution, neutrophil functional activity, and APP response in abruptly weaned beef calves compared with non-weaned (control) calves
16 male beef calves at pasture with their dams -7

16 male beef calves at pasture with their dams -7

All calves housed on d 0

W = Housed and weaned

C = Housed and not weaned (controls)

Days relative to housing
Results -
Neutrophil number

-7  0  2  7  14

Cell number (×10³/µl)

a
b,x

a

S × T: P < 0.001

a,b means differ (P < 0.05) from pre-weaning baseline (d 0)

x,y means differ (P < 0.05) between treatments

Con
Wean

Weaning at housing

Day

S: Sampling time
T: Treatment
Neutrophil L-selectin surface expression

CD62L, MFI

-7  0  2  7  14
Day

a   b,y   a   a

a,b means differ (P < 0.05) from pre-weaning baseline (d 0)

x,y means differ (P < 0.05) between treatments

S × T: P < 0.01

S: Sampling time
T: Treatment

Weaning at housing
Phagocytosing neutrophils, %

Neutrophil phagocytic activity

-7                              0         2                         7                                14

Weaning at housing

Day

Phagocytosing neutrophils, %

a    b,y                    a                            a

a     b,x                   a                            a

a,b means differ (P < 0.05) from pre-weaning baseline (d 0)

x,y means differ (P < 0.05) between treatments

S: Sampling time

T: Treatment
**CD4⁺ T cells**

<table>
<thead>
<tr>
<th>Day</th>
<th>S</th>
<th>T: Con</th>
<th>T: Wean</th>
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</thead>
<tbody>
<tr>
<td>-7</td>
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<td></td>
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<tr>
<td>0</td>
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<td>14</td>
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- **S**: Sampling time
- **T**: Treatment

**Weaning at housing**

- Means differ (P < 0.05) from pre-weaning baseline (d 0)
- Means differ (P < 0.05) between treatments

**S × T: P < 0.05**
CD8⁺ T cells

Weaning at housing

-7 0 2 7 14

Day

Con

Wean

S × T: P < 0.01

Means differ (P < 0.05) from pre-weaning baseline (d 0)

Means differ (P < 0.05) between treatments

S: Sampling time

T: Treatment
WC1+ T cells

S × T: P < 0.001

-7 0 2 7 14

Day

Weaning at housing

a,b means differ (P < 0.05) from pre-weaning baseline (d 0)
x,y means differ (P < 0.05) between treatments

a b,y a a

Day

Weaning at housing

S: Sampling time
T: Treatment
MHC Class II+ cells

-7 0 2 7 14

Weaning at housing

Day

Con
Wean

S: Sampling time
T: Treatment

MHC Class II+, %

S × T: P < 0.001

a, b means differ (P < 0.05) from pre-weaning baseline (d 0)

x, y means differ (P < 0.05) between treatments

a       b, x                  a                             a
a       b, y                  a                            a

Weaning at housing
# Results – Neutrophils

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<thead>
<tr>
<th>Variable</th>
<th>Control</th>
<th>Wean</th>
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<tr>
<td>Neutrophil number</td>
<td>↑↓</td>
<td>↑↓</td>
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<tr>
<td>L-selectin, CD62L⁺ MFI</td>
<td>↑↓</td>
<td>↓</td>
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<tr>
<td>Phagocytic activity</td>
<td>↓</td>
<td>↓↓↓</td>
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The Irish Agriculture and Food Development Authority
<table>
<thead>
<tr>
<th>Variable</th>
<th>Control</th>
<th>Wean</th>
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<tbody>
<tr>
<td>CD4&lt;sup&gt;+&lt;/sup&gt;T cells, %</td>
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<td>”</td>
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<tr>
<td>(Helper)</td>
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<tr>
<td>CD8&lt;sup&gt;+&lt;/sup&gt;T cells, %</td>
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<td>(Cytotoxic)</td>
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<td>WC1&lt;sup&gt;+&lt;/sup&gt;T cells, %</td>
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<td>MHC class II&lt;sup&gt;+&lt;/sup&gt; cells, %</td>
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Conclusions

Abrupt weaning at housing:

- Increased neutrophil number and impaired trafficking and phagocytic function

- Together with the changes in lymphocyte subsets, the results suggest that there was a greater transitory reduction in immune function at housing in abruptly weaned than non-weaned beef calves.
Thank you for your attention