**Introduction**

- **Effects of weaning**
  - Underfeeding
  - BW ↓
  - Intestinal modifications
    - Morphological
    - Immunological
    - Digestion and absorption
    - Intestinal flora
  - Metabolic modifications
  - Endocrinial modifications

**Plan**

- **Introduction**
  - Pig weaning
  - Bovine colostrum
- **Bovine colostrum in the weaning diet**
  - Growth performance and feed intake
  - Digestive and immune system
- **Conclusions**

**Introduction**

- **Weaning = Critical period**

  ![Stress Diagram]

- **Psychological**
  - Separation
  - Manipulation
  - Transport
- **Nutritional**
  - Solid food
  - Composition
- **Environmental**
  - Mixing
  - New environment

**Introduction**

- **Use of feed additives**
  - Ban on antibiotics
  - Colostrum as alternative
Introduction

- **Bovine Colostrum**
  - 1st milk after calving
  - Composition
    - Essential nutrients
    - Bioactive compounds
      - Growth factors (IGF-I and -II, GH, EGF, TGF)
      - Immune factors (Ig, cytokines)
      - Antimicrobial factors (lactoferrin, lactoperoxidase, lysozymes)

<table>
<thead>
<tr>
<th>Bovine Colostrum and milk composition</th>
<th>Composition (g)</th>
<th>Colostrum</th>
<th>Milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Matter</td>
<td></td>
<td>24-51 g</td>
<td>2-4 g</td>
</tr>
<tr>
<td>Crude Fat</td>
<td>36-44 g</td>
<td>24-32 g</td>
<td></td>
</tr>
<tr>
<td>Lactose</td>
<td>39-44 g</td>
<td>7-14 g</td>
<td></td>
</tr>
<tr>
<td>Ash</td>
<td>5-28 g</td>
<td>0-7 g</td>
<td></td>
</tr>
<tr>
<td>IgA</td>
<td>3.0-6.5 g</td>
<td>0.2 g</td>
<td></td>
</tr>
<tr>
<td>IgG1</td>
<td>50-90 g</td>
<td>0.3-0.4 g</td>
<td></td>
</tr>
<tr>
<td>IgG2</td>
<td>1.5-2.2 g</td>
<td>0.05 g</td>
<td></td>
</tr>
<tr>
<td>IgM</td>
<td>3.8-8.6 g</td>
<td>0.05 g</td>
<td></td>
</tr>
<tr>
<td>IGF-I</td>
<td>100-2000 µg</td>
<td>&lt; 25 µg</td>
<td></td>
</tr>
<tr>
<td>IGF-II</td>
<td>200-600 µg</td>
<td>&lt; 10 µg</td>
<td></td>
</tr>
<tr>
<td>EGF</td>
<td>4-8 mg</td>
<td>2 µg</td>
<td></td>
</tr>
<tr>
<td>TGF-β</td>
<td>100-300 pg</td>
<td>1-2 µg</td>
<td></td>
</tr>
<tr>
<td>Lactoferrin</td>
<td>1.5-5.5 mg</td>
<td>0.1-0.3 g</td>
<td></td>
</tr>
<tr>
<td>Lactoperoxidase</td>
<td>10 mg</td>
<td>20 µg</td>
<td></td>
</tr>
<tr>
<td>Lysozyme</td>
<td>0.14-0.7 mg</td>
<td>0.07-0.6 mg</td>
<td></td>
</tr>
</tbody>
</table>

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Bovine colostrum in weaning diet

- Growth performance and feed intake
  - 20 g of BC serum/kg of diet (Boudry et al., 2008)

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[Graph showing ADG (g/day) and FCR (Feed Conversion Ratio) over days post-weaning for control and Bovine Colostrum]
Bovine colostrum in weaning diet

– Growth performance and feed intake
  • ➤ ADG and ADFI Week 1 PW
  • ➣ FCR Week 1 PW
  • First studies in 1999: 5 to 10 % of BC
  • Last studies: 1 % of BC
  • Pathogen pressure

– Gastro-intestinal tract
  • Morphology (King et al., 2007 and 2008)
    – ➤ villi length
    – ➣ crypt depth
  • duodenal protein synthesis (Le Huerou-Luron et al., 2003)
    ➤ Maintain the intestinal barrier integrity

  • Microflora (Huguet et al., 2006)
    – ➤ Lactobacilli/Coliform
    – ➣ Stomach pH (Gram -)
    ➣ ➣ diarrhoea risk

– Immune system
  • Systemic response (Boudry et al., 2007 and 2008)
    – ➤ total IgA
  • Local response (Boudry et al., 2007)
    – ➤ anti-colostral IgA
    – Cytokine expression : Th1 and Th2 immune response
    – Mainly in the iPP (Primary immune organ) : Th2 immune response
    – ➤ of Tc and Th in the lamina propria (King et al., 2008)

– Hormonal response
  • Boudry et al. (in preparation)
    – ➤ in IGF-I on day 7 : Feed intake ???
    – No effect on T3 and T4 on day 7 : decrease after weaning
      but returned faster to initial level

Conclusion
Conclusion

• Bovine colostrum supplementation
  – Increase growth performance and feed intake
  – Maintain intestinal barrier integrity PW
  – Induce a humoral immune response

• In pig production
  – Bovine colostrum = 60 €/kg
  – 1% during 7 days = 500 g/piglet
    = 0.70 €/piglet

Table 2

<table>
<thead>
<tr>
<th>Treatment</th>
<th>ADG and ADFI Week 1 PW</th>
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<th>ADG and ADFI Week 1 PW</th>
<th>ADG and ADFI Week 1 PW</th>
</tr>
</thead>
<tbody>
<tr>
<td>BC</td>
<td>4.57 ± 0.42</td>
<td>4.67 ± 0.42</td>
<td>4.67 ± 0.42</td>
<td>4.57 ± 0.42</td>
</tr>
<tr>
<td>Control</td>
<td>4.17 ± 0.37</td>
<td>4.17 ± 0.37</td>
<td>4.17 ± 0.37</td>
<td>4.17 ± 0.37</td>
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</tbody>
</table>

Table 3

<table>
<thead>
<tr>
<th>Treatment</th>
<th>ABS</th>
<th>BW on d7</th>
<th>BW on d14</th>
<th>Jejunum and ileum VH</th>
</tr>
</thead>
<tbody>
<tr>
<td>BC</td>
<td>52.3 ± 2.4</td>
<td>45.7 ± 3.2</td>
<td>47.8 ± 3.5</td>
<td>1.10 ± 0.05</td>
</tr>
<tr>
<td>Control</td>
<td>49.2 ± 2.1</td>
<td>43.1 ± 2.8</td>
<td>45.6 ± 2.9</td>
<td>1.08 ± 0.04</td>
</tr>
</tbody>
</table>

Table 4

<table>
<thead>
<tr>
<th>Treatment</th>
<th>SI lactase</th>
<th>SI aminopeptidase N</th>
<th>SI mucosa weight</th>
<th>SI protein content</th>
</tr>
</thead>
<tbody>
<tr>
<td>BC</td>
<td>101 ± 5.6</td>
<td>98 ± 4.8</td>
<td>102 ± 6.2</td>
<td>100 ± 5.4</td>
</tr>
<tr>
<td>Control</td>
<td>96 ± 4.3</td>
<td>94 ± 3.9</td>
<td>97 ± 4.1</td>
<td>96 ± 4.3</td>
</tr>
</tbody>
</table>