Bovine colostrum: an efficient and cost-effective growth promoter in piglet weaning diet

Session 18, Abstract N°3291

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Introduction
Introduction

- Weaning = Critical period

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

- Effects of weaning
  - Underfeeding
  - Intestinal modifications
    - Morphological
    - Immunological
    - Digestion and absorption
    - Intestinal flora
  - Metabolic modifications
  - Endocrinal modifications

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

• Bovine Colostrum
  • 1\textsuperscript{st} milking
  • Composition:
    – Essential nutrients
    – Bioactive compounds:
      • Growth factors (IGF-I and –II, GH, EGF, TGF)
      • Immunologic defence factors (Ig, cytokines)
      • Non-immunologic defence factors (lactoferrin, lactoperoxidase, lysozymes)
<table>
<thead>
<tr>
<th>Composition (/l)</th>
<th>Colostrum</th>
<th>Milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Matter</td>
<td>239 g</td>
<td>129 g</td>
</tr>
<tr>
<td>Crude Proteins</td>
<td>140 g</td>
<td>40 g</td>
</tr>
<tr>
<td>Crude Fat</td>
<td>67 g</td>
<td>40 g</td>
</tr>
<tr>
<td>Lactose</td>
<td>27 g</td>
<td>49 g</td>
</tr>
<tr>
<td>Ash</td>
<td>11,1 g</td>
<td>7,4 g</td>
</tr>
<tr>
<td>IgA</td>
<td>3,2-6,2 g</td>
<td>0,2 g</td>
</tr>
<tr>
<td>IgG1</td>
<td>48-87 g</td>
<td>0,4 g</td>
</tr>
<tr>
<td>IgG2</td>
<td>1,6-2,9 g</td>
<td>0,05 g</td>
</tr>
<tr>
<td>IgM</td>
<td>3,7-6,1 g</td>
<td>0,05 g</td>
</tr>
<tr>
<td>IGF-I</td>
<td>0,1-2 mg</td>
<td>25 µg</td>
</tr>
<tr>
<td>IGF-II</td>
<td>0,1-2 mg</td>
<td>2 µg</td>
</tr>
<tr>
<td>TGF-β</td>
<td>20-40 µg</td>
<td>1-2 µg</td>
</tr>
<tr>
<td>EGF</td>
<td>4-8 µg</td>
<td>2 µg</td>
</tr>
<tr>
<td>Lactoferrin</td>
<td>1,5-2 g</td>
<td>0,1 g</td>
</tr>
<tr>
<td>Lysozyme</td>
<td>0,1-0,7 mg</td>
<td>0,1-0,3 mg</td>
</tr>
<tr>
<td>Lactoperoxidase</td>
<td>30 mg</td>
<td>20 mg</td>
</tr>
<tr>
<td>GH</td>
<td>3-10 ng</td>
<td>nd</td>
</tr>
<tr>
<td>Insulin</td>
<td>20-50 µg</td>
<td>nd</td>
</tr>
</tbody>
</table>
Introduction

• Bovine Colostrum
  • 1st milking
  • Composition:
    – Essential nutrients
    – Bioactive compounds
  • Availability:
    – Colostrum Bank
    – 80 000 litres collected/year WR
Introduction

• Bovine colostrum in weaning diet
  • ↑ ADG and ADFI Week 1 PW
  • ↓ FCR Week 1 PW
<table>
<thead>
<tr>
<th>References</th>
<th>BC supplementation</th>
<th>Piglets</th>
<th>Effects of BC vs. control treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Description</td>
<td>n</td>
<td>Weaning age</td>
</tr>
<tr>
<td>Pluske et al., 1999</td>
<td>BC powder rich in IgG</td>
<td>131</td>
<td>28 d</td>
</tr>
<tr>
<td></td>
<td>0, 50 and 100 during 10 d</td>
<td></td>
<td></td>
</tr>
<tr>
<td>King et al., 2001</td>
<td>Spray-dried BC</td>
<td>110</td>
<td>28 d</td>
</tr>
<tr>
<td></td>
<td>0 and 60 during 7 d</td>
<td></td>
<td></td>
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<tr>
<td>Dunshea et al., 2002</td>
<td>Freeze-dried BC</td>
<td>24</td>
<td>14 d</td>
</tr>
<tr>
<td></td>
<td>0 and 60 during 7 d</td>
<td></td>
<td></td>
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<tr>
<td>Le Hueroü-Luron et al., 2004</td>
<td>Freeze-dried BC</td>
<td>150</td>
<td>28 d</td>
</tr>
<tr>
<td></td>
<td>0 and 40 during 11 d in uncleaned pens</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0, 20 and 40 during 14 d in clean pens</td>
<td>12</td>
<td>21 d</td>
</tr>
<tr>
<td>Le Hueroü-Luron et al., 2008</td>
<td>Freeze-dried BC</td>
<td>60</td>
<td>28 d</td>
</tr>
<tr>
<td></td>
<td>0 and 30 during 12 d</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Boudry et al., 2008. BASE, 12 : 157-170
• Bovine colostrum in weaning diet
    – 20 g/kg of freeze-dried BC Whey for 10 d, then 10 g/kg for 18 d
    – commercial weaning-diet without feed additives
    – weaned piglets (28 d)
    – n = 48 (4 * 12)
    – Measures: Weekly ADG, ADFI, FCR
    – Results:
      • ↑ ADG (+ 100 %) and ADFI (+ 35 %) Week 1 PW
      • ↓ FCR (- 50 %) Week 1 PW
    – Cost: 1.9 €/piglet
Experiments
Objectives

- Reduce the costs of the use of bovine colostrum:
  - Level of incorporation (Experiment 1)
  - Duration of administration (Experiment 2)
  - BC fraction (Experiment 3)
Experiment 1

• **Experimental design**
  • 0, 10 or 20 g/kg of freeze-dried BC Whey for 28 d
  • commercial weaning-diet without feed additives
  • weaned piglets (28 d)
  • n = 39 (3 * 13)
• Measures:
  – Weekly ADG, ADFI, FCR
  – Daily ADFI the 1\textsuperscript{st} week PW
  – Visual control of diarrhoea
Experiment 1

- Results

### ADG

- **Week post-weaning:**
  - **1st week:** 
    - Whey 0: 0 g/day
    - Whey 1: 100 g/day
    - Whey 2: 200 g/day
  - **2nd week:** 
    - Whey 0: 0 g/day
    - Whey 1: 150 g/day
    - Whey 2: 300 g/day
  - **3rd week:** 
    - Whey 0: 0 g/day
    - Whey 1: 250 g/day
    - Whey 2: 500 g/day
  - **4th week:** 
    - Whey 0: 0 g/day
    - Whey 1: 350 g/day
    - Whey 2: 700 g/day

### ADFI

- **Week post-weaning:**
  - **1st week:** 
    - Whey 0: 0 g/day
    - Whey 1: 200 g/day
    - Whey 2: 400 g/day
  - **2nd week:** 
    - Whey 0: 0 g/day
    - Whey 1: 300 g/day
    - Whey 2: 600 g/day
  - **3rd week:** 
    - Whey 0: 0 g/day
    - Whey 1: 400 g/day
    - Whey 2: 800 g/day
  - **4th week:** 
    - Whey 0: 0 g/day
    - Whey 1: 500 g/day
    - Whey 2: 1000 g/day

### FCR

- **Week post-weaning:**
  - **1st week:** 
    - Whey 0: 1
    - Whey 1: 2
    - Whey 2: 3
  - **2nd week:** 
    - Whey 0: 1
    - Whey 1: 2
    - Whey 2: 3
  - **3rd week:** 
    - Whey 0: 1
    - Whey 1: 2
    - Whey 2: 3
  - **4th week:** 
    - Whey 0: 1
    - Whey 1: 2
    - Whey 2: 3
**Experiment 1**

- **Results**

![Graph showing the results of Experiment 1 with days post-weaning on the x-axis and grams of feed on the y-axis. Different Whey treatments are indicated with different bar colors: Whey 0 (white), Whey 1 (black), and Whey 2 (gray). The graph highlights changes in feed intake, with a note on days D0 to D7 and a mention of a decrease in feed intake associated with diarrhoea.](image-url)


**Experiment 2**

- **Experimental design**
  - 0, 20 g/kg of freeze-dried BC Whey for 10 d
  - commercial weaning-diet without feed additives
  - weaned piglets (28 d)
  - \( n = 48 \) (4 * 12)
  - **Measures**:
    - Weekly ADG, ADFI, FCR for 28 d
    - Daily ADFI the 1\(^{\text{st}}\) week PW
    - Visual control of diarrhoea
• Results

- ADG
  - Week post-weaning:
    - 1: 100
    - 2: 200
    - 3: 300
    - 4: 400

- ADFI
  - Week post-weaning:
    - 1: 0
    - 2: 200
    - 3: 400
    - 4: 600

- FCR
  - Week post-weaning:
    - 1: 2
    - 2: 1
    - 3: 1.5
    - 4: 2

Whey 0 and Whey 2
Experiment 2

• Results

No Diarrhoea
Experiment 3

**Experimental design**

- 10 g/kg of freeze-dried BC Whey, defatted BC or 10 g of milk for 10 d
- commercial weaning-diet without feed additives
- weaned piglets (28 d)
- n = 32 (8 * 4)
- Measures:
  - Weekly ADG, ADFI, FCR for 28 d
  - Daily ADFI the 1st week PW
  - Visual control of diarrhoea
  - E. coli counts in faeces
Experiment 3

• Results

ADG

<table>
<thead>
<tr>
<th>Days post-weaning</th>
<th>0-4</th>
<th>4-7</th>
<th>7-11</th>
<th>11-14</th>
<th>14-21</th>
</tr>
</thead>
<tbody>
<tr>
<td>g/day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* indicates a significant difference

ADFI

<table>
<thead>
<tr>
<th>Days post-weaning</th>
<th>0-4</th>
<th>4-7</th>
<th>7-11</th>
<th>11-14</th>
<th>14-21</th>
</tr>
</thead>
<tbody>
<tr>
<td>g/day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* indicates a significant difference

FCR

<table>
<thead>
<tr>
<th>Week post-weaning</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.2</td>
<td>1.3</td>
<td>1.4</td>
</tr>
</tbody>
</table>

Milk 1 | Col 1 | Whey 1

- Milk 1
- Col 1
- Whey 1
Experiment 3

- **Results**

No Diarrhoea
Conclusion and perspectives
Conclusion

• Growth promoting action confirmed
• Effect of the environment
• Costs reduced
  • 1.9 €/piglet ➔ 0.14 €/piglet