Intermittent suckling improves galactose absorption in weanling pigs

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EAAP 2014 Session 7: Feeding (and management) to improve gut barrier function and immunity in livestock

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Outline

• Background
  • Issues associated with weaning
  • Intermittent suckling

• Hypothesis

• Results and Discussion

• Conclusion

• Benefits to Industry

• Future Research
Background

Weaning of piglets is stressful

Sudden changes in diet and environment

⇒ Solid feed intake
Background

Day 21 suckling  Day 28 weaned

Low feed intake = gut damage

From Cera et al., (1988)
Background

Solid feed intake

- Reduced growth ("growth check")
- Gastrointestinal disease and dysfunction

Morbidity and mortality

Efficiency of Production
Background

Intermittent suckling \(\equiv\) type of gradual weaning

Adaptation time to weaning \(\equiv\) Gastrointestinal tract health?
Measuring Gastrointestinal Health???

Two sugar absorption tests:

Mannitol

Galactose

From Cera et al., (1988)
Mannitol Absorption

Absorption = Passive

Higher plasma mannitol concentration = Greater intestinal surface area
Higher plasma galactose concentration

=\quad\text{Improved intestinal function}
Hypothesis

- Intermittent suckling

Gastrointestinal absorptive capacity of **mannitol** and **galactose**
Thirty-six gilt litters were allocated to 1 of 3 weaning regimes:

- Control, CW28 (n=9) – continuous access to the sow until weaning at **day 28**
- Two intermittent suckling (IS) treatments:
  - IS21 (n=9) – intermittent suckling starting at **day 21** until weaning at **day 28**
  - IS28 (n=9) – intermittent suckling starting at **day 28** until weaning at **day 35**
Materials and Methods

• Creep feed offered *ad libitum* from 10 days of age

• Intermittent suckling treatment groups:

  8am to 4pm for 7 days before weaning
Materials and Methods

1 piglet per litter (n=9) = 10% mannitol (5ml/kg) orally
3 DAYS PREWEANING
4 DAYS POSTWEANING

1 piglet per litter (n=9) = 10% galactose (5ml/kg) orally
4 DAYS POSTWEANING
Results and Discussion
Mannitol absorption before and after weaning

Plasma Mannitol Concentration (nmol/ml)

Day of the Experiment in Relation to Weaning

- CW28
- IS21
- IS28
Higher plasma mannitol concentration = Greater intestinal surface area
Mannitol absorption before and after weaning

Plasma Mannitol Concentration (nmol/ml)

Day of the Experiment in Relation to Weaning

- CW28
- IS21
- IS28
Galactose absorption after weaning

Plasma Galactose Concentration (nmol/ml)

4 Days Post-weaning

- C28
- IS21
- IS28
Higher plasma galactose concentration = Improved intestinal function
Galactose absorption after weaning

Plasma Galactose Concentration (nmol/ml)

4 Days Post-weaning

C28
IS21
IS28
Conclusions

Intermittent suckling + Older weaning age

Gastrointestinal absorptive capacity of **mannitol**

Gastrointestinal absorptive capacity of **galactose**
Industry Implications

Improved gastrointestinal function

- Better performance of pigs after weaning
- Health risks associated with weaning

Efficiency of Production
Future Research

• Examine further the effect intermittent suckling has on gastrointestinal function and integrity

• Understand the mechanisms behind this potential improvement in gastrointestinal function

http://library.med.utah.edu
http://www.aps.uoguelph.ca
http://surveycentral.org
Thank you
References


• Weighing and creep feed days - d13, 20, 27, 30, 34, 37, 41 and 46

• At d46 of age, body weights were similar (P>0.05) across treatments (14.2 ± 2.4 kg).
<table>
<thead>
<tr>
<th>Treatment</th>
<th>CW28(^1) (n=14)</th>
<th>IS21 (n=14)</th>
<th>IS28 (n=13)</th>
<th>SEM</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADG, g</td>
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<td></td>
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<tr>
<td>Day 5 - d 1 pre-weaning</td>
<td>261(^a)</td>
<td>201(^b)</td>
<td>247(^{ab})</td>
<td>10.1</td>
<td>0.038</td>
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<tr>
<td>First 2 d post-weaning</td>
<td>200(^a)</td>
<td>214(^{a})</td>
<td>455(^{b})</td>
<td>29.5</td>
<td>&lt;0.001</td>
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<td>Days 2-6 post-weaning</td>
<td>209(^a)</td>
<td>283(^{a})</td>
<td>421(^{b})</td>
<td>20.2</td>
<td>&lt;0.001</td>
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<tr>
<td>Weaning weight, kg</td>
<td>7.4(^{aax})</td>
<td>6.8(^{aax})</td>
<td>8.3(^{by})</td>
<td>0.16</td>
<td>0.833</td>
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<td>Day 5- d 1 pre-weaning</td>
<td>46(^a)</td>
<td>37(^{a})</td>
<td>98(^{b})</td>
<td>6.7</td>
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<td>Days 2-6 post-weaning</td>
<td>243(^a)</td>
<td>285(^{a})</td>
<td>429(^{b})</td>
<td>18.1</td>
<td>&lt;0.001</td>
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</table>
Growth rate before and after weaning

Average Daily Gain per Piglet (grams)

Day of Experiment in Relation to Weaning (weaning=0)

Start IS

Weaning

IS21

CW28

*
Growth rate before and after weaning

**Average Daily Gain per Piglet (grams)**

- **Start IS**
- **Weaning**

**Day of Experiment in Relation to Weaning (weaning=0)**
Creep feed disappearance before and after weaning (grams per piglet)

<table>
<thead>
<tr>
<th></th>
<th>CW 28</th>
<th>IS21</th>
<th>IS28</th>
<th>SEM</th>
<th>P Value</th>
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<tr>
<td><strong>1 day Pre-weaning</strong></td>
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<tr>
<td>46&lt;sup&gt;a&lt;/sup&gt;</td>
<td>37&lt;sup&gt;a&lt;/sup&gt;</td>
<td>98&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.7</td>
<td>&lt;0.001</td>
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<tr>
<td><strong>2 days Post-weaning</strong></td>
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<td></td>
<td></td>
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<tr>
<td>102&lt;sup&gt;a&lt;/sup&gt;</td>
<td>105&lt;sup&gt;a&lt;/sup&gt;</td>
<td>215&lt;sup&gt;b&lt;/sup&gt;</td>
<td>9.6</td>
<td>&lt;0.001</td>
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<td><strong>6 days Post-weaning</strong></td>
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<tr>
<td>243&lt;sup&gt;a&lt;/sup&gt;</td>
<td>285&lt;sup&gt;a&lt;/sup&gt;</td>
<td>429&lt;sup&gt;b&lt;/sup&gt;</td>
<td>18.1</td>
<td>&lt;0.001</td>
<td></td>
</tr>
</tbody>
</table>
Mannitol absorption before and after weaning

![Graph showing Mannitol absorption](image-url)

**Plasma Mannitol Concentration (nmol/ml)**

- **Preweaning**
- **Postweaning**