Effects of the diet form on health and performance of weaning or fattening pigs

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66th EAAP meeting
S.14 Customised nutrition taking into account the health status of farms and individual animals
Objectives

Lack of recent results about effect of feed form…
- Pelleting: $\uparrow$ digestibility, $\downarrow$ F:G
- Interaction with on-farm conditions, health status…?

4 trials carried out to study …
- the effect of dietary presentation on performance and health:
  $\Rightarrow$ a solution to reduce post weaning diarrhea?
- effect of pelleting on performance of restrictively fed pigs:
  - interaction with sex (gilts (G) vs. castrated males (CM))
  - boar taint risk in entire males (EM)
- comparison of dry meal, pellets, liquid feeding
  - interaction with feeding level and season
Trial 1: weaned pigs
Experimental design

- **Animals & design**
  - 524 weaned piglets *(28 d, 9.0 kg)* in 2 batches
  - *(LWxLd) x (LWxPietrain)*

- **Feeds**

<table>
<thead>
<tr>
<th>Period</th>
<th>d 0 - 14</th>
<th>d 15 - 41</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feeding</td>
<td>Ad libitum</td>
<td></td>
</tr>
<tr>
<td>Composition</td>
<td>cereals, whey, proteins</td>
<td>wheat, barley, wheat feed meal, soybean &amp; rapeseed meals</td>
</tr>
<tr>
<td>Net energy*, MJ/kg</td>
<td>10.7</td>
<td>9.6</td>
</tr>
<tr>
<td>Lysine dig*, g/kg</td>
<td>13.0</td>
<td>11.5</td>
</tr>
</tbody>
</table>

- **Treatments**
  - meal vs pellets
  - standard (cleaned room, 0.33 m²/p) vs poor sanitary conditions (uncleaned, 0.26 m²/p)

*Estimated from chemical composition of ingredients and Evapig ®

August 31, 2015
Trial 1: weaned pigs
Results over the 41-d period

DFI g/d
1000
900
800
700
600
500
standard
poor conditions

ADG g/d
600
550
500
450
400
350
300
standard
poor conditions

FCR
2.00
1.90
1.80
1.70
1.60
1.50
1.40
standard
poor conditions
Trial 1: weaned pigs
Results over the 41-d period

Fecal score

- Meal standard
- Meal poor
- Pellets standard
- Pellets poor

Days

0 10 20 30

Form* San*

0.2 0.4 0.6

August 31, 2015
### Trials 2 & 3: growing pigs

**Experimental design**

- **(LW x Ld) x (LW x Pietrain) pigs**
- **Restricted feeding level**
- **meal vs ground pellets with liquid feeding system**

#### Feedstuffs

<table>
<thead>
<tr>
<th>Trial</th>
<th>n / sex</th>
<th>Feedstuffs</th>
<th>Nutritional values*</th>
<th>BW, kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2 x 120 G+CM</td>
<td>wheat, barley, peas, rapeseed+soybean+sunflower meal</td>
<td>EN, MJ Lys. dig, g</td>
<td>9.65 8.3</td>
</tr>
<tr>
<td>3</td>
<td>80 EM</td>
<td>wheat, barley, soybean+rapeseed meal</td>
<td>EN, MJ Lys. dig, g</td>
<td>9.6 9.2</td>
</tr>
</tbody>
</table>

*Estimated from chemical composition of ingredients and Evapig ®*
Trials 2 & 3: growing pigs

Results

Trial 2 (G+CM)

- DFI g/d
- ADG g/d
- FCR

**Note:**
- Sx* indicates significant difference between genders.
- Form** indicates significant difference between forms.
- a, b indicate specific group differences.
Trials 2 & 3: growing pigs

Results

 Trial 2 (G+CM)

- Lower effect of feed form for gilts?
  - Pellets ➔ carcass yield (+1%, P<0.01)
  - & carcass leanness (+0.4%, P=0.09)
- Health parameters ➔ similar

comments
### Trials 2 & 3: growing pigs

#### Results

#### Trial 3 (EM)

**Growth and carcass parameters**

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<tr>
<th></th>
<th>Meal</th>
<th>Pellets</th>
<th>Stat.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DFI, kg/d</td>
<td>1.98</td>
<td>1.95</td>
<td>t</td>
</tr>
<tr>
<td>ADG, g/d</td>
<td>882</td>
<td>882</td>
<td>NS</td>
</tr>
<tr>
<td>FCR</td>
<td>2.26</td>
<td>2.20</td>
<td>*</td>
</tr>
<tr>
<td>Dressing %</td>
<td>76.5</td>
<td>77.3</td>
<td>NS</td>
</tr>
<tr>
<td>Muscle %</td>
<td>61.9</td>
<td>62.0</td>
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## Trials 2 & 3: growing pigs

### Results

#### Trial 3 (EM)

**Growth and carcass parameters**

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- P = 0.01

% of boars with [skatole] back fat < or > 30 ng/g
### Trial 4: growing pigs

**Experimental design**

- **(LW x Ld) x Pietrain**
- **4 x 120 (G+CM)**
- **Dry meal vs Dry Pellets vs Liquid Feed**

<table>
<thead>
<tr>
<th>Season</th>
<th>Feeding strategy</th>
<th>Feedstuffs</th>
<th>Nutritional value *, /kg</th>
<th>BW, kg</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Initial</td>
</tr>
</tbody>
</table>
| Summer | Ad libitum → plateau | wheat, corn, rapeseed + soybean+ sunflower meals | EN: 9.6 MJ
Lysine dig. :
- growing: 8.7 g
- finishing: 7.7 g | 28.4     | 114.5   |
| Winter | Pair fed         | wheat, barley, soybean + sunflower meals |            | 28.7     | 115.9   |
| Winter | Ad libitum → plateau | wheat, triticale, rapeseed + soybean + sunflower meals |            | 29.2     | 112.1   |
| Summer | Pair fed         | wheat, barley, soybean + sunflower meals |            | 29.3     | 116.0   |

*Estimated from chemical composition of ingredients and Evapig ®*
Effects of meal, pellets and liquid feed

Results of Exp.4

![Graph showing the effects of meal, pellets, and liquid feed on DFI kg/j for growing and finishing stages with different feeding methods.](image)
Effects of meal, pellets and liquid feed

Results of Exp.4
Effects of meal, pellets and liquid feed

Results of Exp.4

![Bar chart showing FCR kg/kg for different feed forms and feeding methods in growing and finishing stages.](image)
Effects of meal, pellets and liquid feed

Results of Exp.4

- Gilts ⇒ similar muscle %
- Barrows with liquid feed ⇒ leanness ⇒ fat depth
- Health parameters ⇒ similar
**Discussion: Feed Conversion Ratio**

<table>
<thead>
<tr>
<th>Trial</th>
<th>Feeding strategy</th>
<th>Dry meal ⇒ pellets</th>
<th>Liquid meal ⇒ pellets</th>
<th>Dry ⇒ liquid meal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ad libitum</td>
<td>-10%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>restricted</td>
<td></td>
<td>-5%</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>restricted</td>
<td></td>
<td>-2%</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>restricted</td>
<td>-5%</td>
<td></td>
<td>+2%</td>
</tr>
<tr>
<td></td>
<td>ad libitum</td>
<td>-4%</td>
<td></td>
<td>+4%</td>
</tr>
</tbody>
</table>

**Literature**

Discussion: feed efficiency

**Pellets**

- Digestibility of nutrients ↔ diet preparation technology
  - Cumulative effects of pelleting and lower particle size (Ball et al, 2012).

**Impact of technological treatment on feed ingredients**

- Limited information / process effects on nutritive value of ingredients (Bikker et al, 2013)

**Liquid feed**

- ? ↔ feed digestibility (Sol et al, 2015)

- Probably key effect of distribution system ingredients
  - Automatized liquid system, wet feeder,..
Discussion: general health parameters

Diet presentation

Stomach acidification

- Meal - ulcer scores (Quéméré et al, 1988; Wondra et al, 1995; Albar & Granier, 1999; Liermann et al, 2015)

- Automated liquid systems - ulcers (Quéméré et al, 1988; Dubroca et al, 2005) but no effect of wet feeder (Albar & Granier, 1999)

Hygiene of liquid feeding: benefits and drawbacks (Kamphues, 2013, Schenkel, 2013)

- Acidification, positive microorganisms, enzymes activity, anti-nutritional substances,..

- Negative microorganisms, toxins, ammonia, biogenic amines, gas,..
■ **Salmonella**

■ **Benefits of meal in *Salmonella* infections**
  - **Risk factors studies** (Vonnahme et al, 2006; Rajić et al, 2007; Corrégé et al, 2009)
  - **Some experimental studies** (Jørgensen et al, 1999; Dahl et al, 1999), but not consistent with (Kjærsgaard et al, 2001; Jørgensen et al, 2003)
  - **Pellets → neutral mucines ⇐ adhesion of *Salmonella* in intestine** (Hedemann et al, 2005; Betscher et al, 2010)

■ **Liquid feed**
  - ⇐ *salmonella* in risk factors studies (Dahl et al, 2000; Kranker et al, 2001; Fablet et al, 2003; Lo Fo Wong et al, 2004; Farzan et al, 2006; Corrégé et al, 2009)

■ **E. coli infections ?**

■ **Benefits of coarse wheat bran on piglet gut health in a K88 challenge** (Molist et al, 2010), but no impact of coarse meal (vs fine pellets) in *E. coli* survival and colonization in GIT (Von und zur Mühlen et al, 2015)
Conclusions

- Questions or additional information needed...
- Effect of process on nutritional value of individual ingredients…
- Accurate evaluation of impact of liquid feed on feed efficiency…
- Impact of coarse meal on piglet digestive health …
Aknowledgements

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