Effect of feed form and particle size on diet digestibility in pigs

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Introduction

- Pelleting has been found to improve the digestibility of feed in pigs (O’Doherty et al., 2000; Lundblad et al., 2011)

- Grinding the diet or dietary components to a fine particle size has also been found to improve nutrient digestibility (Lahaye et al., 2007 and 2008)

- However, the effect of pelleting in combination with fine grinding has not been thoroughly investigated
Aim of study

To investigate the effect of offering finishing pigs a finely or coarsely ground diet in meal or pellet form on nutrient digestibility
Experimental diet:

- One diet was formulated to contain 13.6 MJ/kg DE, 167 g/kg CP and 9.6 g/kg total lysine.

- The diet contained (g/kg):
  - Barley 412, Wheat 360, Soyabean meal 188, Limestone 13.3, Dicalcium Phosphate 7.6, Vegetable oil blend 10.0, Salt, minerals and vitamins, lysine, methionine, Phytase and NSP.

- This diet was mixed and then processed as necessary to generate the various treatments.
Experimental details

In a 2 x 2 factorial design the treatments were:

- **Feed form:**
  - Meal
  - Pellets (steam pelleted)

- **Particle size**
  - Finely ground diet (reflective of compound feed)
  - Coarsely ground diet (reflective of ‘Home milled’ feed)
Particle size profile

The bar chart shows the percentage of particles in different size ranges:
- >2mm
- 1.4-2mm
- 0.5-1.4mm
- <0.5mm

The chart compares fine and coarse particles, with the fine particles represented in orange and the coarse particles in blue.
Experimental details

- 32 boars (PIC 337) used over 4 time periods
- 8 pigs/treatment
- Pigs had an average start weight of 45kg
- Pigs were housed in metabolism crates
- They received a 7 day pre-feed followed by a 7 day faecal and urine collection
- Digestibility of DM, CP, ash and energy was determined
- Dietary DE content was determined
**Effect of Feed Form**

- Pelleting significantly improved DM digestibility and dietary DE content
- Pelleting tended to improve energy and ash digestibility

<table>
<thead>
<tr>
<th>Digestibility of:</th>
<th>Meal</th>
<th>Pellets</th>
<th>SEM</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM (%)</td>
<td>84.2</td>
<td>85.1</td>
<td>0.32</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Energy (%)</td>
<td>82.6</td>
<td>83.8</td>
<td>0.39</td>
<td>0.055</td>
</tr>
<tr>
<td>Crude protein (%)</td>
<td>82.1</td>
<td>83.4</td>
<td>0.63</td>
<td>&gt;0.1</td>
</tr>
<tr>
<td>Ash (%)</td>
<td>59.2</td>
<td>61.2</td>
<td>0.79</td>
<td>0.084</td>
</tr>
<tr>
<td>Digestible energy content (MJ/kg DM)</td>
<td>15.2</td>
<td>15.4</td>
<td>0.07</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>
**Effect of particle size**

<table>
<thead>
<tr>
<th>Digestibility of:</th>
<th>Coarse</th>
<th>Fine</th>
<th>SEM</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM (%)</td>
<td>84.2</td>
<td>85.1</td>
<td>0.32</td>
<td>0.051</td>
</tr>
<tr>
<td>Energy (%)</td>
<td>82.7</td>
<td>83.7</td>
<td>0.39</td>
<td>0.086</td>
</tr>
<tr>
<td>Crude protein (%)</td>
<td>81.5</td>
<td>84.0</td>
<td>0.63</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Ash (%)</td>
<td>59.3</td>
<td>61.1</td>
<td>0.79</td>
<td>&gt;0.1</td>
</tr>
<tr>
<td><strong>Digestible energy content</strong></td>
<td><strong>15.2</strong></td>
<td><strong>15.4</strong></td>
<td><strong>0.07</strong></td>
<td><strong>0.094</strong></td>
</tr>
</tbody>
</table>

- Reducing particle size significantly improved CP digestibility.
- Reducing particle size tended to improve DM and energy digestibility and digestible energy content of the diet.
### Cumulative effect of pelleting and grinding?

<table>
<thead>
<tr>
<th></th>
<th>CP digestibility (%)</th>
<th>Energy digestibility (%)</th>
<th>Digestible energy content (MJ/kg DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse Meal</td>
<td>80.7</td>
<td>81.7</td>
<td>15.02</td>
</tr>
<tr>
<td>Fine Meal</td>
<td>83.5</td>
<td>83.6</td>
<td>15.37</td>
</tr>
<tr>
<td>Coarse Pellet</td>
<td>82.3</td>
<td>83.7</td>
<td>15.44</td>
</tr>
<tr>
<td>Fine Pellet</td>
<td>84.4</td>
<td>83.9</td>
<td>15.45</td>
</tr>
<tr>
<td>SEM</td>
<td>0.90</td>
<td>0.56</td>
<td>0.10</td>
</tr>
<tr>
<td>P Value</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

- 0.4 MJ/kg DM increase in DE content when the diet was manufactured as a ‘fine pellet’ compared to a ‘coarse meal’
Summary

- Pelleting improved diet digestibility and dietary DE content
- Fine grinding improved CP digestibility and tended to improve DE content
- A cumulative beneficial effect of fine grinding and pelleting is suggested since the DE content, CP and energy digestibility of the diet were
  - optimised when the ‘fine pellet’ diet was offered but
  - poorest when the ‘coarse meal’ diet was offered.
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◆ Devenish Nutrition Ltd., Northern Ireland

◆ PCM,

◆ Pig unit staff at AFBI Hillsborough