Reducing nitrogen excretion by adapting feeding programs for growing pigs

**Objective**

In many countries of continental Europe the standard feeding strategy consists in feeding a single diet with at least 17% crude protein from 30 kg up to slaughter. The two consecutive trials presented here aimed at establishing two-phase feeding strategies for optimum performance and decreased nitrogen excretion.

**Experimental Design**

**Animals**

Each of the two trials comprised 108 mixed sex crossbred pigs (Large White x Pietrain) x (Large White x Landrace) housed in groups of six on slatted floors. The average initial weight was 28 kg in the first and 32 kg in the second trial. Slaughter weight was between 102 and 103 kg. Apart from zootechnical performances and carcass quality, the slurry from groups fed on the different diets was collected separately and analyzed.

**Diets**

In both trials the diets were based on wheat, barley, manioc, peas and soybean meal, and at a lower extent on milling byproducts, molasses and fat. Different protein levels in the diets were adjusted by exchanging soybean meal for cereals. L-Lysine HCl was added where necessary to reach the lysine levels as specified in the protocol. L-Threonine and DL-Methionine were used to balance the dietary amino acid patterns. In both trials, a high protein diet fed throughout the grower-finisher period was compared to both a high protein grower/low protein finisher dietary strategy and to lower protein diets for both the grower and the finisher phases. Diets were changed 42 days after the start of the experiment and lysine levels in the low protein finisher diets were also reduced.

**Results**

**Growth Rate and Feed Conversion Ratio**

**Trial 1**

<table>
<thead>
<tr>
<th>Protein (%)</th>
<th>Lysine (%)</th>
<th>Growth Rate (g/d)</th>
<th>FCR (g/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>17.0/17.0</td>
<td>0.92/0.92</td>
<td>773</td>
<td>3.3</td>
</tr>
<tr>
<td>17.0/13.0</td>
<td>0.92/0.68</td>
<td>764</td>
<td>3.02</td>
</tr>
<tr>
<td>14.5/14.5</td>
<td>0.92/0.68</td>
<td>745</td>
<td>2.4</td>
</tr>
</tbody>
</table>

Table 1. Trial 1 nutrient levels

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Crude Protein (%)</th>
<th>Lysine (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Start - 42d</td>
<td>42d - End</td>
</tr>
<tr>
<td>1</td>
<td>17.0</td>
<td>17.0</td>
</tr>
<tr>
<td>2</td>
<td>17.0</td>
<td>13.0</td>
</tr>
<tr>
<td>3</td>
<td>14.5</td>
<td>14.5</td>
</tr>
</tbody>
</table>

Table 2. Trial 2 nutrient levels

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Crude Protein (%)</th>
<th>Lysine (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Start - 42d</td>
<td>42d - End</td>
</tr>
<tr>
<td>1</td>
<td>16.6</td>
<td>16.6</td>
</tr>
<tr>
<td>2</td>
<td>16.6</td>
<td>14.2</td>
</tr>
<tr>
<td>3</td>
<td>15.0</td>
<td>12.1</td>
</tr>
</tbody>
</table>
Trial 2

**Growth Rate (g/d)**

- Protein (%): 16.6/16.6, 16.6/14.2, 15.0/12.1
- Lysine (%): 0.93/0.93, 0.93/0.80
- Values: 781, 795, 786
- Growth Rate: 2.92, 2.89, 2.91

**FCR (g/g)**

- Protein (%): 16.6/16.6, 16.6/14.2, 15.0/12.1
- Lysine (%): 0.93/0.93, 0.93/0.80
- Values: 55.5, 56.67, 57.11

**Carcass Quality (mm/muscle)**

- Protein (%): 16.6/16.6, 16.6/14.2, 15.0/12.1
- Lysine (%): 0.93/0.93, 0.93/0.80
- Values: 58, 58.42, 58

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**Trial 1**

**Carcass Quality (mm/muscle)**

- Protein (%): 17.0/17.0, 17.0/13.0, 14.5/14.5
- Lysine (%): 0.92/0.92, 0.92/0.68
- Values: 56.75, 58.42, 58

**N emissions and N in slurry at end of trial**

- Protein (%): 17.0/17.0, 17.0/13.0, 14.5/14.5
- Lysine (%): 0.92/0.92, 0.92/0.68
- Values: 9.5, 8.1, 8.4

**N kg/pig produced**

- Protein (%): 17.0/17.0, 17.0/13.0, 14.5/14.5
- Lysine (%): 0.92/0.92, 0.92/0.68
- Values: 3.85, 3.14, 3.42

**N % dry matter in slurry**

- Protein (%): 17.0/17.0, 17.0/13.0, 14.5/14.5
- Lysine (%): 0.92/0.92, 0.92/0.68
- Values: 2, 3, 4
Discussion

Trial 1

In the first trial only slight difference in growth rate and feed conversion could be observed between the three treatments. However, there was a tendency towards lower performance in the treatments with reduced protein levels. A detailed analysis by period (growing - finishing) and sex (castrated males - females), revealed that the slightly inferior results of the phase feeding treatments (2 and 3) were essentially due to a lower performance of the female pigs in the finisher phase. For these animals with high lysine requirements the level of 0.68% lysine in the finisher diet was obviously insufficient.

In contrast, in the grower phase performances in all groups were identical irrespective of the protein level, because lysine levels were the same in all groups. From the first trial it could therefore be concluded that protein levels can largely be reduced provided the supply of lysine is adequate.

Trial 2

In the second experiment, the protein levels in the phase feeding treatments were even lower to further investigate the possibility of decreasing dietary protein, but lysine in the finisher phase was increased compared to trial 1. As a result the low protein phase feeding treatments (2 and 3) produced the same results as treatment 1.

The slaughter results were good for practical conditions giving evidence for the high genetic capacity of the animals used. There was no treatment effect on estimated lean meat percentage while cutlet depth tended to be positively affected by the low protein diets.

The reduction in nitrogen emission measured is a consequence of the reduction in nitrogen input through feed. Compared to current feeding practice the feeding strategies 2 and 3 in trial II resulted in both the best technical results and nitrogen emissions were reduced by more than 20%.

Conclusion

- In pigs with high potential for lean deposition, the feed protein level can be reduced to 14.5% in the grower feed and below 13% in the finisher feed.
- Reduced dietary protein and phase feeding allow a reduction of nitrogen emissions of more than 20%.
- Lean meat yield can be maintained if low protein diets meet the requirements for essential amino acids.

Bibliography
