The effect of linseed expeller supplementation on growth, carcass traits and meat colour of finishing gilts


Department of Animal Science
INTRODUCTION

- Pork is the most consumed meat in the world, and its fatty acid content and composition is directly influenced by diet.

- The idea of modifying the fatty acid composition of pork to make it more healthful.

- Consumers relate the perception of meat quality with visual appearance characteristics:
  - Subcutaneous fat content
  - Drip loss
  - Colour.....
## INTRODUCTION

### LINSEED EXPELLER

<table>
<thead>
<tr>
<th></th>
<th>Linseed expeller</th>
</tr>
</thead>
<tbody>
<tr>
<td>EM (kcal/kg)</td>
<td>2970</td>
</tr>
<tr>
<td>Crude Protein(%)</td>
<td>32.4</td>
</tr>
<tr>
<td>SFA (% total of fatty acids)</td>
<td>8.7</td>
</tr>
<tr>
<td>MUFA (% total of fatty acids)</td>
<td>18.6</td>
</tr>
<tr>
<td>ω-6 (% total of fatty acids)</td>
<td>17.9</td>
</tr>
<tr>
<td>ω-3 (% total of fatty acids)</td>
<td>54.8</td>
</tr>
<tr>
<td>balance ω-6 / AGPI ω-3</td>
<td>0.3</td>
</tr>
</tbody>
</table>
INTRODUCTION

- Balance between level of inclusion and length of supplementation period
INTRODUCTION

- Effect of linseed meal on c18:3 (g/Kg) in pigs slaughtered at 115kg of BW

<table>
<thead>
<tr>
<th>Item</th>
<th>0 Flaxseed level in diet g/ Kg</th>
<th>5 Flaxseed level in diet g/ Kg</th>
<th>10 Flaxseed level in diet g/ Kg</th>
<th>15 Flaxseed level in diet g/ Kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>α-linolenic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Backfat</td>
<td>11.1</td>
<td>21.7</td>
<td>34.4</td>
<td>47.4</td>
</tr>
<tr>
<td>Loin</td>
<td>5.0</td>
<td>6.4</td>
<td>9.3</td>
<td>10.1</td>
</tr>
</tbody>
</table>

Eastwood et al.2009
OBJECTIVES

• To Evaluate the effect of linseed expeller supplementation on carcass traits, meat colour and fatty acids profile of finishing gilts.
MATERIAL AND METHODS

Animal

• 82 crossbred gilts (Landrace--Large-White x Pietrain)
  Age (168±3 days)
  Initial Body-Weight (92.5±2kg)

• Gilts were housed in 4 pens (20-21 pigs each) based on initial BW
MATERIAL AND METHODS

Experimental diet

- There were 2 treatments:

1) Growing-finishing feed **(control)** ad libitum (2365 kcal EN/kg, 1.0% Lys, vit E 29 mg/kg)

2) Growing-finishing feed ad libitum with a supplement of linseed expeller top-dressing **(supplementation)** + 0.5 kg/day of supplement (level of inclusion 15% of the expected daily intake)

During 21 days
MATERIAL AND METHODS
Slaughtering and carcass quality traits

• In vivo:
  • Final Body-Weight (same day, before departure to slaughter)
  • Daily gain
✓ 24h fasting time
✓ 1,5 h lairage time

• Post-mortem:
  • Carcass Weight
  • Back-fat depth using an on-line ultrasound automatic scanner (Autofom):
    1. At the 3th-4th last rib area
    2. At the last lumbar vertebrae

Half of the gilts were sampled for loin evaluation:
• 400g of caudal Longissimus thoracis muscle
MATERIAL AND METHODS
Technological and chemical composition of meat

• **pH**: 45min and 24h post mortem

• **WBSF**: cooked at internal temp 70ºC (sample 30x10mm) with a texturer analyser . TX2.

• **Cooking loss**

• **IMF**

• **Crude protein**
MATERIAL AND METHODS
Map Storage and colour

1-cm slices were stored in modified atmosphere package (MAP, 70% O₂, 30% CO₂) at 4 º C for colour assessment:

1. Colour attributes (CIELab) with a chromameter (Minolta Camera, Japan).

At days 1, 4, 8 and 12.
MATERIAL AND METHODS

Intramuscular fatty acids

- **Measure %IMF** (intramuscular fatty acids) with Soxhlet extractor: 4g of lyophilized and homogenized meat.

- **Fatty acid profile**: Direct transesterification with boron trifluoride 20% in methanol (100mg sample) and quantification by GC.
MATERIAL AND METHODS

Statistical analysis

• Data were analysed using the JMP Pro 11 Statistical software (SAS. USA).

• Carcass parameters, pH, IMF composition were analysed with general linear model (GLM procedure) with treatment as fixed effect.

• Colour attributes were analysed with a linear mixed model including as well the effect of storage day.

• The level of significance was set at 0.05. Differences were assessed using the Tukey test.
RESULTS AND DISCUSSION

Growth data

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Supplement</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final weight (kg)</td>
<td>109.8</td>
<td>107.7</td>
<td>0.48</td>
</tr>
<tr>
<td>Average daily gain (g)</td>
<td>689</td>
<td>739</td>
<td>0.42</td>
</tr>
<tr>
<td>Carcass weight (kg)</td>
<td>75.5</td>
<td>83.1</td>
<td>0.45</td>
</tr>
<tr>
<td>Backfat depth 3\textsuperscript{rd}-4\textsuperscript{th} last rib (mm)</td>
<td>22.8</td>
<td>24.6</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Backfat depth last lumbar vertebrae (mm)</td>
<td>10.9</td>
<td>12.5</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

The final weight, daily gain and carcass weight did not differ between groups. Linseed supplement increased backfat depth.
### RESULTS AND DISCUSSION

#### Meat Quality traits

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Supplement</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>WB Shear force (kg)</td>
<td>5.73±0.16</td>
<td>5.69±0.18</td>
<td>0.99</td>
</tr>
<tr>
<td>Cooking loss (%)</td>
<td>17.0±0.97</td>
<td>16.3±1.15</td>
<td>0.63</td>
</tr>
<tr>
<td>Moisture (%)</td>
<td>72.9±0.36</td>
<td>72.9±0.42</td>
<td>0.93</td>
</tr>
<tr>
<td>Crude protein (%)</td>
<td>21.5±0.26</td>
<td>21.8±0.30</td>
<td>0.48</td>
</tr>
<tr>
<td>IMF (%)</td>
<td>2.33±0.17</td>
<td>2.69±0.36</td>
<td>0.32</td>
</tr>
</tbody>
</table>

The WB Shear force, cooking loss, moisture, crude protein and did not differ between groups.
RESULTS AND DISCUSSION
pH

There are no differences in pH between groups.

<table>
<thead>
<tr>
<th></th>
<th>pH 45min</th>
<th>pH 24h</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>6.37±0.07</td>
<td>5.65±0.03</td>
<td>0.48</td>
</tr>
<tr>
<td>Supplement</td>
<td>6.45±0.08</td>
<td>5.56±0.03</td>
<td>0.19</td>
</tr>
</tbody>
</table>
RESULTS AND DISCUSSION

Colour score

![Graph showing the change in redness index (a*) over days of MAP storage (70%O2 30%CO2) for control and linseed samples.](image-url)
RESULTS AND DISCUSSION

Map Storage

![Graph showing the effect of MAP storage on metmyoglobin levels with control and linseed conditions. The graph displays the increase in metmyoglobin (K/S 572/525) over days of storage (70% O2, 30% CO2) with markers indicating control and linseed samples.](image)
RESULTS AND DISCUSSION
Japanese Colour score
## RESULTS AND DISCUSSION

### Profile fatty acids

<table>
<thead>
<tr>
<th>Item</th>
<th>Control</th>
<th>Linseed Supplementation</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SFA (%)</td>
<td>26.09±0.21</td>
<td>25.39±0.23</td>
<td>0.04*</td>
</tr>
<tr>
<td>MUFA (%)</td>
<td>45.77œ0.69</td>
<td>44.53œ0.84</td>
<td>0.26</td>
</tr>
<tr>
<td>PUFA (%)</td>
<td>17.18œ0.79</td>
<td>19.37œ1.02</td>
<td>0.09</td>
</tr>
<tr>
<td>Omega 6 (%)</td>
<td>12.57œ0.49</td>
<td>13.72œ0.62</td>
<td>0.15</td>
</tr>
<tr>
<td>Omega 3(%)</td>
<td>0.77±0.04</td>
<td>1.37±0.10</td>
<td>&lt;0.001*</td>
</tr>
</tbody>
</table>

There were differences in SFA and ©-3 contents.
RESULTS AND DISCUSSION
Profile fatty acids

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<thead>
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<th>Control</th>
<th>Linseed Supplementation</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>C18:3 n-3</td>
<td>0.53±0.02</td>
<td>0.92±0.07</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>C22:6 n-3</td>
<td>0.11±0.01</td>
<td>0.15±0.01</td>
<td>0.023*</td>
</tr>
</tbody>
</table>
CONCLUSIONS

A top-dressed linseed supplement (15% of diet inclusion during the last 21 days of fattening):

- Increased carcass adiposity without negatively affecting the muscle pH, shear force, cooking loss or meat colour.
- Did not affect visual appearance of loin slices during at least 8 days of display storage.
- Did not increase IMF significantly but it modified the FA composition by increasing PUFA n-3 content.
ONGOING RESEARCH

Technological quality traits and PUFA n-3 content is maintained in cooked and MAP stored meat from pigs fed n-3 rich sources? → studies to assess the effect of cooking and storage in MAP on the fatty acid profile.
AKNOWLEDGEMENTS

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Universitat de Lleida
Thank you for attention!