Amino acid digestibility and energy concentration in soybean and rapeseed products fed to pigs

D. M. D. L. Navarro*, Y. Liu, T. Bruun, and H. H. Stein

University of Illinois, Urbana IL

Abstract 19168
Outline

• Background
• Digestibility experiments
  – Materials and Methods
  – Results
  – Conclusions
• Overall conclusions
Soybean Products
Soybean Meal

- Premier protein source
- Excellent AA profile
  - high in Lys and Trp
- Antinutritional factors
  - Transient hypersensitivity response
Enzyme-treated Soybean Meal

- Fermentation process
- Reduction of antigenic proteins
  - $\beta$-conglycinin
- Increased CP and AA

Goebel and Stein, 2011
00-Rapeseed
00-Rapeseed

- Low erucic and low glucosinolate varieties
- Desirable AA profile
  - Met and Cys
- Antinutritional factors
  - High fiber concentration
Test Ingredients

1. Enzyme-treated SBM (ESBM-1)
2. ESBM-2
3. Enzyme-fortified extruded SBM (SBM-EX)
4. Soy protein concentrate (SPC)
5. Conventional SBM (SBM-CV)
6. Conventional 00-rapeseed expellers (RSE)
7. Fermented co-product mixture (FCM)
## Nutrient Composition, as-fed

<table>
<thead>
<tr>
<th></th>
<th>ESBM-1</th>
<th>ESBM-2</th>
<th>SBM-EX</th>
<th>SPC</th>
<th>SBM-CV</th>
<th>RSE</th>
<th>FCM</th>
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<tbody>
<tr>
<td>DM, %</td>
<td>92.0</td>
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<td>91.7</td>
<td>88.7</td>
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<tr>
<td>CP, %</td>
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<td>NDF, %</td>
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<td>12.7</td>
<td>19.7</td>
<td>7.8</td>
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<td>22.9</td>
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<tr>
<td>GE, kcal/kg</td>
<td>4,555</td>
<td>4,380</td>
<td>4,454</td>
<td>4,499</td>
<td>4,140</td>
<td>4,533</td>
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Exp. 1
Amino Acid Digestibility
Objective

• To determine the standardized ileal digestibility of AA in soybean products and 00-rapeseed co-products fed to weanling pigs.
Materials & Methods

• 27 weanling barrows (initial BW: 9.29 ± 0.58 kg)

• 9 x 5 Youden square
  – 9 pigs per replicate and 3 replicates per period
  – 5 periods
  – 9 diets (7 ingredients and N-free)
## Diet Composition

<table>
<thead>
<tr>
<th></th>
<th>ESBM-1</th>
<th>ESBM-2</th>
<th>SBM-EX</th>
<th>SPC</th>
<th>SBM-CV</th>
<th>RSE</th>
<th>FCM</th>
<th>N-free</th>
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<td>-</td>
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<tr>
<td>SPC</td>
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<tr>
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<td>40.0</td>
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<td>-</td>
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<tr>
<td>FCM</td>
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<tr>
<td>Others</td>
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<td>3.4</td>
<td>3.1</td>
<td>3.1</td>
<td>8.5</td>
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</tbody>
</table>
Materials & Methods

- SID of AA was calculated
- Statistical analysis
  - Proc Mixed of SAS
  - Fixed effect
    - Diet
  - Random effect
    - Pig and period
Results
SID of Lys, %

- ESBM-1: 87.3
- ESBM-2: 82.5
- SBM-EX: 86.4
- SPC: 86.5
- SBM-CV: 89.2
- RSE: 80.2
- FCM: 64.2

P < 0.01
SID of Met, %

<table>
<thead>
<tr>
<th>Method</th>
<th>SID</th>
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<tbody>
<tr>
<td>ESBM-1</td>
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<tr>
<td>ESBM-2</td>
<td>90.5</td>
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<tr>
<td>SBM-EX</td>
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<tr>
<td>SPC</td>
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<tr>
<td>SBM-CV</td>
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<tr>
<td>RSE</td>
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<tr>
<td>FCM</td>
<td>83.7</td>
</tr>
</tbody>
</table>

P < 0.01
SID of Thr, %

P < 0.01
SID of Trp, %

- ESBM-1: 93.3
- ESBM-2: 90.0
- SBM-EX: 91.1
- SPC: 86.0
- SBM-CV: 92.3
- RSE: 89.0
- FCM: 85.3

P < 0.01
Conclusions

• Processing of SBM results in increased CP concentration and does not change AA digestibility.

• The SID of AA was different among processed soybean products.

• Fermentation of a co-product mixture results in decreased SID values compared with unfermented 00-rapeseed expellers and soybean products.
Exp. 2
Energy Concentration
Objective

• To determine the concentrations of DE and ME in soybean products and 00-rapeseed co-products fed to growing pigs.
Materials & Methods

- 64 barrows (initial BW: 19.81 ± 0.90 kg)
- RCBD
  - 8 treatments with 8 replicates per treatment
- Difference procedure
## Diet Composition

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<thead>
<tr>
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<th>Corn</th>
<th>ESBM-1</th>
<th>ESBM-2</th>
<th>SBM-EX</th>
<th>SPC</th>
<th>SBM-CV</th>
<th>RSE</th>
<th>FCM</th>
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</thead>
<tbody>
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<tr>
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<td>22.8</td>
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<td>RSE</td>
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<td>2.9</td>
<td>3.0</td>
<td>2.9</td>
<td>2.4</td>
<td>2.6</td>
</tr>
</tbody>
</table>
Results
ATTD of GE, %

- Corn: 88.2
- ESBM-1: 86.9
- ESBM-2: 85.1
- SBM-EX: 87.2
- SPC: 87.2
- SBM-CV: 92.4
- RSE: 72.6
- FCM: 71.7

P < 0.01

Labels: a, b, c
DE of ingredients, kcal/kg DM

- Corn: 3,864
- ESBM-1: 4,349
- ESBM-2: 4,121
- SBM-EX: 4,432
- SPC: 4,460
- SBM-CV: 4,303
- RSE: 3,793
- FCM: 3,610

Significance:
- c < a < b < a < ab < cd < d

P < 0.01
Conclusions

• DE and ME were different among processed soybean products.

• DE and ME in the soybean products were greater than in 00-rapeseed expellers and the fermented co-product mixture.
Overall Conclusions

• The process used to produce ESBM-2 was less efficient compared with ESBM-1.

• Fermentation of a co-product mixture results in decreased SID of AA, DE, and ME.
Acknowledgements
Hans H. Stein
Monogastric Nutrition Laboratory

http://nutrition.anisci.illinois.edu