Non-starch polysaccharide composition influences the energy value of grains and grain co-products fed to pigs

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Take Home Message

• Grains and grain co-products contain a large NSP substrate for NSP-degrading enzymes to target

• NSP composition plays an important role in determining the extent of fermentation of NSP

• NSP amount and composition influences the energy value of ingredients & diets
Outline

- Introduction to fiber analysis
- Exp. 1 – Non-starch polysaccharide analysis
- Exp. 2 – In vitro digestibility of NSP
- Exp. 3 – Energy digestibility
- Conclusions
Ingredients

- Corn
  - Distillers dried grains with solubles (DDGS)
- Sorghum
  - Sorghum DDGS
- Wheat
  - Wheat bran
% NSP as a % of T-NSP

Corn, 8.1% T-NSP
- Other hemicelluloses: 29.8%
- Cellulose: 21.6%
- Arabinoxylans: 48.6%

Corn DDGS, 25.0% T-NSP
- Other hemicelluloses: 28.0%
- Cellulose: 23.3%
- Arabinoxylans: 48.7%
% NSP as a % of T-NSP

Sorghum, 6.6% T-NSP
- Cellulose: 22.9%
- Other hemicelluloses: 32.8%
- Arabinoxylans: 44.3%

Sorghum DDGS, 24.7% T-NSP
- Cellulose: 27.3%
- Other hemicelluloses: 31.5%
- Arabinoxylans: 41.2%
% NSP as a % of T-NSP

**Wheat, 9.5% T-NSP**
- Arabinoxylans: 63.0%
- Other hemicelluloses: 22.8%
- Cellulose: 14.3%

**Wheat bran, 34.5% T-NSP**
- Arabinoxylans: 64.3%
- Other hemicelluloses: 18.4%
- Cellulose: 17.3%
In Vitro Total Tract Digestibility of NSP, %

- Corn: 33.6%
- cDDGS: 32.7%
- Sorghum: 15.5%
- sDDGS: 26.9%
- Wheat: 44.9%
- Wheat Bran: 20.6%
- Corn DDGS (cDDGS): 6.4%
- Sorghum DDGS (sDDGS): 6.1%
- Wheat: 4.0%
In Vitro DM Digestibility vs. [NSP]

\[ y = -1.0616x + 100.12 \]

\[ R^2 = 0.9702 \]
Total Dietary Fiber, %

- **Basal**
  - Insoluble: 3.8
  - Soluble: 3.95
  - Total: 15.02

- **15% Wheat bran**
  - Insoluble: 5.7
  - Soluble: 3.61
  - Total: 20.45

- **30% Wheat bran**
  - Insoluble: 12.1
  - Soluble: 2.11
  - Total: 25.51
ATTD of GE vs. [TDF]

\[ y = -1.2446x + 115.59 \]

\[ R^2 = 0.9995 \]

Linear 
\[ P < 0.01 \]
ATTD of ADF, %

- Basal: 79.6%
- 15% Wheat bran: 61.3%
- 30% Wheat bran: 52.22%

Linear: $P < 0.01$
Quadratic: $P < 0.05$
ATTD of NDF, %

- Basal: 74.17%
- 15% Wheat bran: 65.42%
- 30% Wheat bran: 64.71%

Linear relationship: $P < 0.01$
Methane Production, L/d

- Basal: 4.83
- 15% Wheat bran: 3.21
- 30% Wheat bran: 1.48

Linear
$P < 0.01$
Daily Heat Production, kcal/kg BW^{0.6}

- Basal: 301 kcal/kg BW^{0.6}
- 15% Wheat bran: 297 kcal/kg BW^{0.6}
- 30% Wheat bran: 288 kcal/kg BW^{0.6}

Linear
$P < 0.01$
Dietary NE, kcal/kg DM

- Basal: 2,076 kcal/kg DM
- 15% Wheat bran: 1,812 kcal/kg DM
- 30% Wheat bran: 1,683 kcal/kg DM

Linear effect: $P < 0.01$
Conclusion

1. NSP composition is not affected by processing
2. In vitro NSP digestibility is influenced by I:S
3. In vitro DM digestibility & ATTD of GE are reduced by increased NSP and TDF
4. Methane and heat production are influenced by type and amount of NSP
5. All of which influence Net Energy