The energetic value of non-starch polysaccharides in Nile tilapia

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- Carbohydrates classification
  - Low molecular sugars and starch (enzymes).
  - Non-starch polysaccharides (not digested).
  - Quantitative data on NSP digestibility.

- Fish-meal and fish-oil supplies
  - Use of plant ingredients (Carbohydrates).
  - Changes in diet composition.
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- Balanced diet formulation
  1) Nutrient digestibility
  2) Maintenance and growth requirements
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Why this study

1. Can Nile tilapia “digest” NSP?

2. Can the digested NSP be utilized for:
   - maintenance and growth
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Fish and housing

- All male Nile Tilapia (44g).
- 18 tanks all on one RAS (70L, 34 fish/tank)
- Water quality identical.
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- **Diets and feeding**
  - Treatments in 2x3 factorial design:
  - 2 diets: NSP vs. starch. “by including DDGS”

<table>
<thead>
<tr>
<th>Analysed</th>
<th>Starch Diet</th>
<th>NSP Diet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starch (g/kg)</td>
<td>354</td>
<td>241</td>
</tr>
<tr>
<td>NSP (g/kg)</td>
<td>171</td>
<td>286</td>
</tr>
<tr>
<td>Protein (g/kg)</td>
<td>333</td>
<td>328</td>
</tr>
<tr>
<td>Fat (g/kg)</td>
<td>73</td>
<td>73</td>
</tr>
</tbody>
</table>

- **3 feeding levels**
  - 45% ; 80% and 100%
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- Measurements
  - Performance
  - Nutrient digestibility (Yttrium oxide as marker)
  - Body composition
  - Energy and Nitrogen balances
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Results

- Diet (P<0.05)
- Feeding level (P<0.001)
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- Diet (P<0.001). Feeding level (P<0.001)
- NSP digestibility (22-73%)
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The effect of diet type on nutrients digestibility.

<table>
<thead>
<tr>
<th>Apparent digestibility (%)</th>
<th>Starch diet</th>
<th>NSP diet</th>
<th>SEM</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Diet</td>
<td>Level</td>
<td>Diet*level</td>
<td></td>
</tr>
<tr>
<td>Protein</td>
<td>91.8</td>
<td>91.0</td>
<td>0.30</td>
<td>0.007</td>
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<tr>
<td></td>
<td>99.2</td>
<td>&lt;.001</td>
<td>0.036</td>
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<tr>
<td>Energy</td>
<td>85.8</td>
<td>83.7</td>
<td>0.87</td>
<td>0.010</td>
</tr>
<tr>
<td></td>
<td>98.3</td>
<td>&lt;.001</td>
<td>0.193</td>
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</tr>
<tr>
<td>Starch</td>
<td>78.6</td>
<td>75.0</td>
<td>1.31</td>
<td>0.006</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt;.001</td>
<td>0.147</td>
<td></td>
</tr>
</tbody>
</table>
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- DE originating → digested protein (90 kJ kg⁻⁰.₈ BW d⁻¹)
- DE originating → digested fat (34 kJ kg⁻⁰.₈ BW d⁻¹).
- 17% of DE → NSP Diet.
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Results

- Two way Anova: RE $\rightarrow$ Diet (P< 0.05). Feeding level (P<0.001).
- Regression $\rightarrow$ (numerical difference).
  - Maintenance = 96 & 110 (kJ kg$^{-0.8}$ BW d$^{-1}$)
  - Utilization efficiency = 65% & 58%
The energetic value of non-starch polysaccharides in Nile tilapia

- NSP is digested in Nile tilapia (22%-73%)
- Up to 17% of DE originated from NSP in Nile tilapia.
- Increasing NSP content resulted in lower retained energy
- Digested NSP are less well utilized for growth due to:
  1. numerically higher Maintenance
  2. numerically lower utilization efficiency.
Thank you for your attention