Investigation of Thai Plants as Potential Sources of Fructan and Inulin Main Fractions

Kunchit Judprasong, Siriporn Tanjor, Pongtorn Sungpuag and Prapasri Puwastien

Institute of Nutrition, Mahidol University, Salaya, Phutthamonthon, Nakorn Pathom 73170, THAILAND nukjp@mahidol.ac.th

Fructan - one of carbohydrates substance
- fructose polymer - linked with \( \beta(1-2) \) glycosidic bonds

- Inulin - a mixture of fructose polymers with a chain length from 2 to 60 units (DP 2-60) usually with a terminal unit of glucose.

- Fructo-oligosaccharide (FOS) or Oligofructose - is a partial enzymatic hydrolysis of inulin which has a chain oligomers with DP<10.

Sources: Jerusalem artichoke, chicory, banana, onion, garlic

8th International Food Data Conference
October 1-3, 2009
Bangkok, Thailand
Health benefit effects

- **as soluble dietary fiber** - cannot be digested by the enzymes of the human small intestine
  - Low calorie carbohydrate - ~ 1.5 Kcal/g
  - Produced by fermentation: SCFA and lactate

- **as prebiotic** - promote the growth of bifidobacteria and suppress pathogens
  - Relieving constipation
  - Low glycemic index and improve glucose regulation
  - Improvement of the bioavailability of calcium
  - Reduction of serum cholesterol concentrations and triglycerides

Why method of fructan analysis is developed?

- **AOAC method 985.29** for total dietary fiber analysis - can not detected inulin or oligofructose
  (soluble in the alcohol of the precipitation step)

- **AOAC method 997.08** for fructan analysis - determination of the released fructose and glucose before and after hydrolysis with enzyme
Sources of fructan in Thai Foods

No information of fructan content in Thai foods

Objective

To investigate potential sources of fructan and inulin main fractions in selected Thai plant foods.

Materials and Methods

Samples: Forty-eight commonly consumed Thai plants from 5 food groups:

- Starchy roots and tubers: 12 samples
- Vegetables: 13 samples
- Fruits: 7 samples
- Spices: 11 samples
- Seeds and nuts: 5 samples
Fructans analysis: AOAC Method 997.08, 2005
AOAC Inter., Joye D., 2000

Test Portion
~1 g fructan freeze-dried sample

Extraction dissolution
Boiling water; pH 6.5-8.0, 10 min, 85°C

Sugar analysis 1
(native sugars: glucose, sucrose, and fructose)
15 g extract, 15 g buffer pH 4.5,
Amyloglucosidase, 30 min, 60°C

Sugar analysis 2
Inulinase, 30 min, 60°C

Sugar analysis 3
(released glucose and fructose)

SP230 Hydrolysis

Flow diagram of extraction and hydrolysis for determination of fructan in foods by High temp. Gas Chromatography

Results

- Method validation
- The fructans and fructooligosaccharide* content of selected Thai plants (screening from 48 varieties, n=1)
- The fructans and fructooligosaccharide* content of selected 8 food items Thai plants (n=3 each)

* FOS = Sum of Fructo-oligosaccharide (GF2, GF2 and GF4)
where: GF2 is 1-kestose (1-kestotriose), GF3 is nystose, and GF4 is 1F-β-fructofuranosylnystose
Method validation

Accuracy:

% Recovery of standard inulin powder (Beneo™, Belgium) = 98.5 ± 3.4%

Precision:

Repeatability: < 2%RSD
Reproducibility: 4.4%RSD

QC sample (in-house quality control material):
fortified fructan milk powder (Nestle™), analysed along with each set of analysis, mean+SD = 2.74±0.12 g/100g

Results and Discussion

The fructan and FOS content of selected Thai plants (screening from 48 varieties)
Results and Discussion

The fructan and FOS content of selected potential sources (n=3)

<table>
<thead>
<tr>
<th>Source</th>
<th>Fructan (%)</th>
<th>FOS (%)</th>
<th>Fructan (g/100g FW)</th>
<th>FOS (g/100g FW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Garlic</td>
<td>5.6%</td>
<td>26.5%</td>
<td>0.9±0.1</td>
<td>2.6±0.2</td>
</tr>
<tr>
<td>Chinese garlic</td>
<td>7.7%</td>
<td>87%</td>
<td>1.6±0.2</td>
<td>3.0±0.3</td>
</tr>
<tr>
<td>Garlic</td>
<td>7.2%</td>
<td>20.6%</td>
<td>1.4±0.1</td>
<td>2.8±0.2</td>
</tr>
<tr>
<td>Jerusalem artichoke</td>
<td>20.6%</td>
<td>20.6%</td>
<td>5.1±0.1</td>
<td>4.2±0.2</td>
</tr>
<tr>
<td>Shallot</td>
<td>8.2%</td>
<td>57%</td>
<td>1.2±0.1</td>
<td>2.8±0.2</td>
</tr>
<tr>
<td>Red onion</td>
<td>17.3%</td>
<td>57%</td>
<td>2.1±0.1</td>
<td>3.5±0.2</td>
</tr>
<tr>
<td>Cashew nut tree</td>
<td>20.6%</td>
<td>20.6%</td>
<td>5.1±0.1</td>
<td>4.2±0.2</td>
</tr>
<tr>
<td>Onion</td>
<td>57%</td>
<td>57%</td>
<td>2.1±0.1</td>
<td>3.5±0.2</td>
</tr>
</tbody>
</table>

Results and Discussion

The fructan content of Jerusalem artichoke (16 varieties)

The fructan contents range from 14.1 to 20.4 g/100g FW.

Poster No. S3-P-7
Conclusion

High fructan content:
- Great headed garlic
- Chinese garlic
- Garlic
- Jerusalem artichoke (Kaentawan)
- Shallot

High FOS content:
- Jerusalem artichoke (Kaentawan)
- Shallot
- Red onion

Further activities

- Promote consumption of recipes containing good sources of fructan
- Artichoke: promote consumption as fresh or as recipes use as fructan fortificants in low calories food products.
Acknowledgements

Mahidol University’s Research Fund for supporting this research

Thank you
Kob Kun Krub