A Toast to your Health!
« Enhancing beverages with pulse ingredients»

Joyce Boye
Pulse Symposium
5th February 2009, Toronto
Outline

- Market overview and potential
- Pulse ingredients in yogurt formulation
- Pulse ingredients in beverage applications
- Whole grain-based beverages
- Conclusion
The Growing Pulse Food Industry
The Growing Pulse Food Industry

Pulses

- Salads
- Snacks
- Masala
- Baking
- Beverages
- Soups
- ?
- ?
- ?

*The image shows a diagram with the title "The Growing Pulse Food Industry." It includes various categories such as Salads, Snacks, Masala, Baking, Beverages, Soups, and spaces labeled with question marks.*
Beverages

**Types:**

- Soda
- Hot beverages
- Dairy and non-dairy (e.g., soy) products
- Alcoholic beverages
- Liquid nutrition (e.g., Ensure)
- Sports/energy drinks
- Protein powders/mixes
US beverage consumption pattern for the year 2006 (volume growth in %)

Source: Beverage Digest Fact book, 2007
Health issues on soft drinks consumption

- Obesity
- GI distress
- Calcium crises
- Hypertension
- Dental problems
- Kidney disorder
- Malnutrition
- Post menopausal syndrome
Beverages

Trends:

- On-the-go
- Better 4 U
- Kids health
- Reduced calories
- Sports/health/energy
- Environmental consciousness
• Excellent source of calcium and vitamin D
• Gluten- and lactose-free
• No trans fat
• Kosher

High protein
High fibre
Glucerna is a pleasant-tasting nutritional supplement specifically designed for people with diabetes. It has a unique slow-release carbohydrate system and is clinically proven to provide more consistent blood glucose levels compared to a standard medical nutritional drink or snack bar.1,2
Select the BOOST that's right for you!

- BOOST Drink
- BOOST Smoothie
- BOOST High Protein
- Kid Essentials
- BOOST Glucose Control

http://www.boost.com/Products/ourproducts_boostplus.aspx
Research Question

Could pulses, their proteins, starches and fibres be used as ingredients in the development of different beverages?
Pulse-based beverages

Potential Markets:

- Lactose-free/dairy-free
- Vegetarian
- High fibre/high protein drinks
- Heart health
- Sports drinks
- Non-allergenic/Hypo-allergenic
Probiotic/high fibre/high protein beverages

Opportunity:

High protein

Fibre – Legumes

Probiotics/Prebiotics

Bacteria
Fibre

Colonic health
Yoghurt/Probiotic Applications

Objectives:

• Study of the acidification rate of yoghurt cultures in the presence and absence of selected pulse fractions during an 18-hour incubation period.

• Same study as above but with probiotic cultures to determine if pulse fractions have any suppressive effects.
Experimental plan

• **Two** commercial yogurt cultures: commercial brands name (Yogourmet and Yogotherm)

• **Two** probiotic cultures provided from supplier:
  1-L.b rhamnosus
  2-L.b acidophilus

• Acidification rate was studied at:
  – 42 °C
  – 18 hours incubation

• Each culture was tested in triplicate
Experimental plan

6 Pulse fractions added (at 2%) to skim milk fortified with milk powder as yoghurt media.

• Samples:
  – pea protein
  – chickpea flour
  – lentil flour
  – pea fibre
  – soy protein concentrate
  – soy flour
  – two blank samples ((a)with and (b)without extra milk powder)
Acidification rate: Yoghurt culture (Yogotherm)
Acidification rate: Yoghurt culture (Yogourmet)

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- pea protein
- chickpea flour
- lentil flour
- pea fiber
- soy protein concentrate
- soy flour
- blank+milk powder
- blank
Acidification rate: Probiotic culture (L. b rhamnosus)

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- pea protein
- chickpea flour
- lentil flour
- pea fiber
- soy protein concentrate
- soy flour
- blank + milk powder
- blank
Acidification rate: Probiotic culture (L.b acidophilus)
Experimental Design for Beverage Development

• Juice supplementation with pulse fractions (1-4% w/v)
  – Apple juice (Unfiltered, unpasteurised)
  – Orange juice (Freshly squeezed)
  – Carrot Juice
  – Tomato juice

• Whole legume beverage development
  – Lentil flour
  – Chickpea flour
  – Pea protein
Juice preparation

Control
Control + Pectin

Supplementation: (a) pulse fractions (1-4 %) / pea fibre (0.6, 1.25 %) (b) soy protein (2 %)

Homogenization (2750 rpm/ 5 min)

Pasteurization (90 C/1 min)

Filling + Storage

Physico-chemical analysis
Sensory analysis
Sensory evaluation

No of panellist: 25 (Untrained)
Volume of sample: 15 ml
Method of analysis: 9-point Hedonic scale
Parameters tested: Flavour, Mouthfeel, Overall rating
## Questionnaire for sensory evaluation

### Flavour
- **1.** Like extremely
- **2.** Like very much
- **3.** Like moderately
- **4.** Like slightly
- **5.** Neither like nor dislike
- **6.** Dislike slightly
- **7.** Dislike moderately
- **8.** Dislike very much
- **9.** Dislike extremely

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### Mouth feel
- **1.** Like extremely
- **2.** Like very much
- **3.** Like moderately
- **4.** Like slightly
- **5.** Neither like nor dislike
- **6.** Dislike slightly
- **7.** Dislike moderately
- **8.** Dislike very much
- **9.** Dislike extremely

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### Global rating
- **1.** Like extremely
- **2.** Like very much
- **3.** Like moderately
- **4.** Like slightly
- **5.** Neither like nor dislike
- **6.** Dislike slightly
- **7.** Dislike moderately
- **8.** Dislike very much
- **9.** Dislike extremely

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### Additional Comments:

……………………………………
Sensory test results: Apple Juice

Flavor

- Blank
- Apple juice + pectin
- Apple juice + soy protein concentrate
- Apple juice + 1% pea protein
- Apple juice + 2% pea protein
- Apple juice + 1% chickpea flour
- Apple juice + 2% chickpea flour
- Apple juice + 1% lentil flour
- Apple juice + 2% lentil flour
Sensory test results: Apple Juice

Mouthfeel

Blank  Apple juice + pectin  Apple juice + soy protein concentrate  Apple juice + 1% pea protein  Apple juice + 2% pea protein  Apple juice + 1% chickpea flour  Apple juice + 2% chickpea flour  Apple juice + 1% lentil flour  Apple juice + 2% lentil flour
Sensory test results: Apple Juice

Overall acceptance

- Blank
- Apple juice + pectin
- Apple juice + soy protein concentrate
- Apple juice + 1% pea protein
- Apple juice + 2% pea protein
- Apple juice + 1% chickpea flour
- Apple juice + 2% chickpea flour
- Apple juice + 1% lentil flour
- Apple juice + 2% lentil flour

Scores:
- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
### Apple Juice Supplementation

<table>
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<tr>
<th>Sample</th>
<th>Flavor</th>
<th>Mouth feel</th>
<th>Global Rating</th>
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<tbody>
<tr>
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<td>✔</td>
<td>✔</td>
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<tr>
<td>2% pea protein</td>
<td>★</td>
<td>★</td>
<td>★</td>
</tr>
<tr>
<td>1% chickpea flour</td>
<td>✔</td>
<td>★</td>
<td>✔</td>
</tr>
<tr>
<td>2% chickpea flour</td>
<td>★</td>
<td>★</td>
<td>★</td>
</tr>
<tr>
<td>1% lentil flour</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>2% lentil flour</td>
<td>★</td>
<td>★</td>
<td>★</td>
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Particle size/solubility?
Sensory test results: Orange juice

Average scores for flavor

- Blank
- Orange juice + pectin
- Orange juice + soy protein concentrate
- Orange juice + 1% pea protein
- Orange juice + 2% pea protein
- Orange juice + 1% chickpea flour
- Orange juice + 2% chickpea flour
- Orange juice + 1% lentil flour
- Orange juice + 2% lentil flour
- Orange juice + 1.25% pea fiber
- Orange juice + 0.6% pea fiber
Sensory test results: Orange juice
Sensory test results: Orange juice

Overall acceptance

- Blank
- Orange juice + pectin
- Orange juice + soy protein concentrate
- Orange juice + 1% pea protein
- Orange juice + 2% pea protein
- Orange juice + chickpea flour
- Orange juice + 2% chickpea flour
- Orange juice + 1% lentil flour
- Orange juice + 2% lentil flour
- Orange juice + 1.25% pea fiber
- Orange juice + 0.6% pea fiber
# Summary:

**Orange Juice**

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<th>Mouthfeel</th>
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<tr>
<td>2% pea protein</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>1% chickpea flour</td>
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<tr>
<td>2% chickpea flour</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1% lentil flour</td>
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</tr>
<tr>
<td>2% lentil flour</td>
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</tr>
<tr>
<td>0.625% pea fiber</td>
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<tr>
<td>1.25% pea fiber</td>
<td>X</td>
<td>X</td>
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</table>
Outline

- Market overview
- Pulse ingredients in yogurt formulation
- Pulse ingredients in beverage applications
- Whole grain-based beverages
- Conclusion
Technical Considerations

Grain-based beverage processing:

- Enzyme inhibitors
- Beany flavor
- Long cooking times
- Color (comparison to milk)
- Viscosity (high starch/fibre)
Processing of grain-based beverages

Legume

NaHCO₃ – reduces beany flavour

Addition of other ingredients

Soaking

Grinding

Filtration

Cooking

Milk
Technical Considerations

Processing:

- Heat inactivation
- Airless processing
- Deodorisation
- Masking agents
- Flavouring agents
Soymilk Flavour Profile

Effect of vacuum flashing:

![Graph showing the effect of vacuum flushing on Soymilk flavour profile](chart.png)

- **3 Pentanone**
- **Pentanal**
- **Hexanal**
- **Hexanol**
- **2-Heptanone**
- **Heptanal**
- **Benzaldehyde**
- **2-Pentyl furan**
- **Nonanal**

**Time of Vacuum Flushing (min)**
Soymilk Flavour Profile

SPME GC-MS: Standards

SPME GC-MS: Commercial soymilks
Total volatile compounds identified in different pea cultivars

- Acids
- Alcohols
- Sulfur compounds
- Aldehydes
- Aromatic compounds
- Alkane
- Ketones
- Terpenes
- Esters
Characteristics of a Chocolate Beverage from Germinated Chickpeas

MARIA LUZ-FERNANDEZ DE TONELLA and JAMES W. BERRY

ABSTRACT

A chocolate flavored beverage was developed using germinated chickpeas (Cicer arietinum). The formulation included the legume at a level of 10% along with sugar, cocoa, salt, vegetable oil and water as main ingredients. Beverage prepared from germinated chickpeas showed reduced viscosity and improved consistency when compared with a control formulated from ungerminated chickpeas. A reduction of 15% in starch occurred during germination and probably accounted for most of the observed decrease in viscosity. The acceptability of the beverage was established by sensory evaluation. A paired preference test indicated no significant difference between germinated chickpea beverage and a commercial chocolate milk.

726—JOURNAL OF FOOD SCIENCE—Volume 52, No. 3, 1987
Grian germination

**Benefits:**

- Reduction in enzyme inhibitors
- Increase in limiting amino acids
- Increase in vitamins/ascorbic acid
- Increase in $\alpha$-amylase/starch hydrolysis
- Improvements in functionality
Outline

- Market overview
- Pulse ingredients in yogurt formulation
- Pulse ingredients in beverage applications
- Whole grain-based beverages
- Conclusion
Objective: USDA-ARS is currently looking for companies with expertise in food ingredient manufacturing and food product development.

Overview: ARS researchers in California have developed a way to produce legume-based flours and powders using both conventional and non-conventional ingredients. This food processing technology can be used to produce pulse legumes, pulse legume based flours and protein powders directly and/or as nano particles suspended in liquid to form beverages. This technology could be used to make a line of nutritional or functional food products. Lactose and diary-free beverages, such as grain-based products, like soy, are experiencing considerable demand as an increasing number of consumers ...
This technology could open international markets for an underutilized commodity. Additionally, new markets for lactose and dairy-free, nutritional and healthy vegetarian and grain based beverages will benefit the health status of consumers.

**Industry Type:** The ideal partner will have expertise in developing sports drinks and nutritional drink supplements, and the ability to contribute both intellectually and financially to the project.
NUTREN Fibre with Prebio1 contains 8.8 grams/1000 ml of pea fibre and 5.2 grams/1000ml of Prebio1, a unique blend of FOS/Inulin, to facilitate feeding tolerance throughout the colon.

**Indications**
- Ideal for long-term tube feeding
- Mild vanilla taste for oral use
- Ready-to-use cans and pre-filled non-air-dependent UltraPak®
- Patients who would benefit from fibre and prebiotics: living with chronic diarrhea and patients on antibiotic therapy.
Ingredients
WATER, MALTODEXTRIN, SUGAR (SUCROSE), SOYBEAN OIL, MILK PROTEIN CONCENTRATE, WHEY PROTEIN CONCENTRATE (FROM COW’S MILK), CANOLA OIL, MEDIUM-CHAIN TRIGLYCERIDES (MCT SOURCE: FRACTIONATED COCONUT AND PALM KERNEL OIL), PEA FIBRE, SOY LECITHIN, DIPOTASSIUM PHOSPHATE, CALCIUM CITRATE, OLIGOFRUCTOSE, SODIUM CHLORIDE, INULIN, ARTIFICIAL VANILLA FLAVOUR, MAGNESIUM CHLORIDE, CHOLINE CHLORIDE, SODIUM ASCORBATE, POTASSIUM CITRATE, POTASSIUMHYDROXIDE, DISODIUM PHOSPHATE, CARRAGEENAN, TAURINE, INOSITOL, L-CARNITINE, FERROUS SULPHATE, ZINC SULPHATE, DL-ALPHA TOCOPHERYL ACETATE, NIACINAMIDE, CALCIUM PANTOTHENATE, FOLIC ACID, MANGANESE SULPHATE, THIAMINE MONONITRATE, COPPER SULPHATE, PYRIDOXINEHYDROCHLORIDE, RIBOFLAVIN, BETA-CAROTENE, RETINYL ACETATE, BIOTIN, POTASSIUM IODIDE, CHROMIUM CHLORIDE, SODIUM SELENATE, SODIUM MOLYBDATE, CHOLECALCIFEROL, CYANOCOBALAMIN.
Product examples

Alive! Vanilla Protein Shake,
Rice & Pea Protein,
Nature's Way, 1.3 lb
Protein isolate/concentrate alternatives

Proteins of soy/pea/rice

Protein shakes (just add water)

Protein powders
The beverage industry’s response

With these strong drivers of growth, it is not surprising that the beverage industry in India has begun to respond with products that are marketed clearly on a health and wellness platform.

In the end, beverage suppliers who unlearn many of the long-held misconceptions about Indian consumers and respond instead to their changing needs and priorities will be best placed to maximize the health and wellness opportunity in this large and growing market.

Conclusion

Further research:

- Economical processing techniques
- Product stability during storage
- Bioavailability of active ingredients
- Flavour studies and improvement
- Consumer acceptability studies
- Marketing strategies
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Research Team:
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