Grain-Based Technologies to Reduce Food Energy Density

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Challenges for Developing Foods with Reduced Energy Density

- Need to target foods consumers love to eat
- Need to reduce fat without compromising flavor and texture or nutritional value
- Products should not present gastrointestinal issues
- Products need to be as easy or easier to prepare than full-fat product
- Environmentally-friendly, economical process for ready adoption by industry
Met Challenges

- TRIM Technologies
- Low-Oil Uptake Rice Batters
THE TRIM TECHNOLOGIES

ALL BECAME COMMERCIAL PRODUCTS

C-Trim

SoyTrim

RiceTrim

QATrim

NU TRIM

Functional fat replacement
**THE TRIM TECHNOLOGIES**

**Soluble Fiber Fat-Replacers**

- **Oat or barley flour or bran**
- **Jet-cooking**

**Specific sequence of steps involving aqueous extraction & jet-cooking**

- **Amylodextrins + 1-15% β-glucan**
- **Low level amylodextrins + 20-50% β-glucan + 14-27% protein + bioactive phenolics**

**Soluble hydrocolloid fraction**

- **α-amylase**
- **Amylodextrins + 1-10% β-glucan**
Amylodextrins provide smooth mouthfeel

Fat replacer

β-glucan provides beneficial physiological effects

Reduction of blood cholesterol

“Tasteless” white powders

Easy to incorporate into food products

Heat stable

Suitable for cooked/baked foods
The Soluble Fiber Fat-Replacers

As dried powder
4 kcal/g compared to 9 kcal/g for fat
Fat-like gel upon hydration and heating
1 kcal/g

Flows like dairy cream, coconut cream, smooth
4 kcal/g

Very high viscosity for increased satiety
2.5 – 3.5 kcal/g
Soft Ice Cream with OATrim: 4 oz serving

- 135 versus 298 calories
- < 1 g versus 22 g fat
- 4 mg versus 85 mg cholesterol
After 1 week standard equilibration diet, 50 g (1/2 cup) OATrim powder in various foods throughout the day for 5 weeks at each of 2 β-glucan levels (0.8-1.2 g or 5.1-7.6 g)

Replaced ¼ to all fat in foods

OATrim supplied 10% calories, other carbohydrates 45%, fat 30%, protein 15%
Decrease in LDL cholesterol without decrease in HDL

Improvement in glucose tolerance
- Reduced insulin levels 11-24%
- Glucagon dropped 16-36%
- Blood glucose levels 7-12% lower

Volunteers lost an average 4.5 lbs

Satiety (gastrointestinal viscosity)
In 5 years from lab to grocery: label as hydrolyzed oat bran

Foods containing OATrim:
- Pasteurized cheeses
- Baked products (breads, cookies, muffins)
- Processed meats
- Extra lean ground beef
- Nutrition bars

Lower fat, not lower standards.
Harness the Power of Oats

Nutrim™
Oat Bran

Silky, creamy mouth feel plus the health benefits of oats.
- Smoothies
- Meal Replacement Beverages
- Desserts
- Soups
- Spreads
- Salad Dressings
- Bars
And much more!

Future Ceuticals
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C-TRIM

- Yogurt
- Smoothies
- Baked goods
- Chocolates
  - 25% replacement of cocoa butter
  - Dramatic increase in taste scores for mouth coating
Insoluble Fiber Fat Replacer

Grain (oats, corn, rice, wheat, soy) bran or hulls

Multi-stage process involving alkali and intensive shearing (jet cooking)

Cellular debris: With textural variation from particle-like structure to creaminess to gel.
Zero-Energy Insoluble Fiber/Fat Replacer

At daily recommended amount of fiber consumed as 1/1 replacement by 75 kg person = 225 kcal reduction in energy

Gels have high viscosity and absorb 24 times weight in water

Satiety

Not as effective as soluble fiber in lowering glucose and insulin responses
Trim Technology — Finally a way to incorporate good carbs.

Trim Down with our family of Good Carbs!

Yours truly,
the “Trim” family

1.888.452.6653 • www.futureceuticals.com • sales@futureceuticals.com
Rice Batter
Unique Properties of Rice Starch and Flour

- Small starch granule: 3-5 microns
- Mouthfeel of fat
- White color, bland taste
- Hypoallergenic
- Gluten-free
Preparation of Batter

- Rice or Wheat Flour plus
  - 1% sodium bicarbonate
  - 3% sodium chloride
  - 0.7% pyrophosphate
  - 70 g of batter base and 80.5 g of water
Fried batter made from rice flour absorbed less oil than that made from wheat flour

- Rice Flour – 28% oil
- Wheat Flour – 49% oil
Hydrophobic wheat gluten gave wheat flour greater affinity for oil than rice flour.

Leavening effect of gluten made it more porous which enhanced moisture release and oil uptake.
Batter was brittle and hard to chew
Low in viscosity
Improved Properties by Adding

- Phosphorylated Starch
- Pre-gelatinized Flour
  - Enhance the batter’s water-holding ability making it a more effective oil barrier during frying
  - Film-forming properties lead to harder crust
## THE BIG TEST: FRIED CHICKEN

<table>
<thead>
<tr>
<th></th>
<th>Wheat</th>
<th>Rice 1.6% P</th>
<th>Rice Pre-Gel</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Viscosity</strong></td>
<td>94 RVU</td>
<td>220 RVU</td>
<td>183 RVU</td>
</tr>
<tr>
<td><strong>Wet Pick-up</strong></td>
<td>13%</td>
<td>21%</td>
<td>18%</td>
</tr>
<tr>
<td><strong>Dry Pick-up</strong></td>
<td>15%</td>
<td>20%</td>
<td>12%</td>
</tr>
<tr>
<td><strong>Oil Fried Batter</strong></td>
<td>38%</td>
<td>14%</td>
<td>20%</td>
</tr>
<tr>
<td><strong>Oil Fried Chicken</strong></td>
<td>5.6%</td>
<td>2.9%</td>
<td>2.4%</td>
</tr>
</tbody>
</table>
Rice Batter

U.S. patent 6,224,921
May 1, 2001 issued
The team Batter Up™ consisting of students from the Enterprise-215 class in the Fall of 2006 assessed commercial feasibility of USDA invented rice batter “Five-guys with a fryer” founded CrispTek and licensed the technology from the USDA in 2008.
Crisp Tek, LLC

Start-Up Funding from Maryland Technology Development Corp.

NeoTech Incubator at Center for Business & Technology

www.choicebatter.com
Cooperative Research & Development Agreement (CRADA)

Research to extend technologies to food service – pre-breaded, frozen food products
Low Oil-Uptake Batter with C-TRIM

- 4% addition of C-trim 30 to wheat batter
  - Increased batter viscosity
  - Increased batter pick-up
  - Reduced moisture loss
  - Reduced oil content 40%
LOOKING INTO THE FUTURE

- Fat-replacers with multiple benefits
  - β-glucan
  - Bioactive polyphenolics
- Rice with higher levels of resistant and slowly digestible starches