Sweetener Strategy: assessing the functionality of natural low-calorie sweeteners in product formulation

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Food Matters
Outline

• Eureka
• Flavour Horizons
• Current consumer environment
• EU Permitted Natural sweeteners
• Category Review
• Sweeteners in the future
• Summary
a NPD consultancy

- Independent
- Technical: ‘hands on’
- Over 35 years of experience
  - >400 retail launches
  - > 30 new ingredients
  - > 20 patents
- Concept through to commercialisation
- Broad product sector and manufacturing experience
- Lateral thinker and practical solution provider
a NPD consultancy

Product areas: Formulations and Processes

- Beverages
- Cereal based goods
- Confectionery
- Dairy
- Nutritional
- Sauces & Condiments
- Savoury
- Toppings & Fillings
A quarterly, electronic bulletin for the food, beverage and flavour industries.

Delivers concise information analysing

- New flavour compounds
- Innovative Technologies
- Flavour industry data
- Regulatory issues
- Patenting activity
- Corporate strategies
- Centres of excellence
CURRENT CONSUMER ENVIRONMENT
Sugar

• SACN (Scientific Advisory Committee on Nutrition) have conducted a scientific review of carbohydrate in our diets

• No effect on:
  • Coronary outcomes
  • Blood pressure
  • Cholesterol
  • Diabetes
  • Blood glucose
  • Blood insulin
Sugar

• We do eat too much and a target intake of free sugars at the population level is 5% of daily energy intake (5-6 teaspoons a day)
• Sugars are cariogenic and lead to tooth decay
• More sugar consumption can lead to higher energy intakes which in turn leads to weight gain and obesity.
Sugar and sweetness

• Consumers need choices to be able to reduce sugars in their diet.
• Traditional synthetic high potency sweeteners (HPS) can offer many an acceptable zero calorie/ sugar choice
• Those looking for natural ingredients are seeking alternatives
EU PERMITTED NATURAL SWEETENERS
Current Natural Sweeteners

- Natural Sweeteners in EU regulated by:
  - Source
  - Application
  - Use level
Thaumatin

- Extracted from Katemfe fruit
- Botanical Name: *Thaumatococcus danielli*
- Thaumatin is a protein
- C. 2,000 times as sweet as sugar
- Delayed onset of intense sweetness with a lingering liquorice aftertaste
- Currently approval in several territories including EU and USA.
Thaumatin

• Available since 1970s
• Limited application
• Poor sweetener
• Great flavour modifier
• Only niche applications
Stevia

- Extracted from Stevia leaf
- Botanical Name: *Stevia rebaudiana*
- Sweet diterpene glycosides
- C. 200 times as sweet as sugar
- Delayed onset of intense sweetness with a lingering liquorice aftertaste
- Currently approval in several territories including EU and USA
Stevia

- Permitted since 2012
- Natural sweetener
- No nutritional value
- Process stable:
  - Temperature
  - pH 3 - 8
  - Light
- Non-fermentable
- Does not affect blood insulin & sugar levels
- Anti-cariogenic
Technical & Marketing Hurdles

- Category technical restrictions
- Technical restrictions:
  - ‘No added sugar’
  - ‘Energy reduced’ defined as 30% calorie reduced
- Quality of sweetness
- Label declaration:
  - ‘Stevia leaf extract’
  - ‘Steviol glycosides’
### Stevia origin

EU recognises 10 steviol glycosides

<table>
<thead>
<tr>
<th>Stevioside</th>
<th>Rebaudioside E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rebaudioside A</td>
<td>Rebaudioside F</td>
</tr>
<tr>
<td>Rebaudioside B</td>
<td>Dulcoside A</td>
</tr>
<tr>
<td>Rebaudioside C</td>
<td>Rubusoside</td>
</tr>
<tr>
<td>Rebaudioside D</td>
<td>Steviolbioside</td>
</tr>
</tbody>
</table>
Detailed understanding of Glycoside interactions

Warm = synergy
Cool = antagonism

Cargill Research
Stevia Extracts

• Unlike the synthetic HPS they are chemically ill defined.
Stevia Extracts

• Unlike the synthetic HPS they are chemically ill defined.
• Leads to many different grades and many different sweetness equivalents/taste profiles.
Stevia Extracts

• Unlike the synthetic HPS they are chemically ill defined
• Leads to many different grades and many different sweetness equivalents/taste profiles
• However, like all HPS, even the 2\textsuperscript{nd} and 3\textsuperscript{rd} generation of stevia extracts have serious taste limitations:
  • Lack flavour carrying capacity
  • Poor sweetness onset
  • Lingering aftertastes
REVIEW BY CATEGORY
Table top category goes green
Performance

• Consumers expect these to be reduced calorie so expect the same of stevia products
• This category starts to explain the ingredient ‘stevia’ but only to users
• Formulation with sugars (mainly sucrose)
• Formulation with Erythritol (natural/ bulk/ zero calorie)
• Leaf motifs and green livery
• It has broadened the category but taken market share from Sucralose previously seen as ‘natural’
UK consumer perception of healthy sweeteners in 2012 and 2013

Source: Canaceian Custom Solutions Omnibus data on 2,000 participants in the UK, May 2012 and September 2013.
# Fruit Juice: Natural and Sweet

<table>
<thead>
<tr>
<th>Fruit</th>
<th>Total sugar (%w/w)</th>
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</thead>
<tbody>
<tr>
<td>Apple</td>
<td>12.0</td>
</tr>
<tr>
<td>Banana</td>
<td>21.0</td>
</tr>
<tr>
<td>Blackcurrants</td>
<td>6.6</td>
</tr>
<tr>
<td>Cherries</td>
<td>11.5</td>
</tr>
<tr>
<td>Gooseberries</td>
<td>3.0</td>
</tr>
<tr>
<td>Grapefruit</td>
<td>7.0</td>
</tr>
<tr>
<td>Mangoes</td>
<td>13.8</td>
</tr>
<tr>
<td>Melon - Honey dew</td>
<td>6.6</td>
</tr>
<tr>
<td>Melon - Water</td>
<td>7.1</td>
</tr>
<tr>
<td>Orange</td>
<td>8.5</td>
</tr>
<tr>
<td>Pear</td>
<td>10.0</td>
</tr>
<tr>
<td>Rhubarb</td>
<td>0.8</td>
</tr>
</tbody>
</table>
Trop50

50% less sugar and calories
Ingredients
FILTERED WATER, NOT FROM CONCENTRATE PASTEURIZED ORANGE JUICE, MALIC ACID, NATURAL FLAVORS, CITRIC ACID AND REB A.

VITAMINS & MINERALS: POTASSIUM CITRATE, ASCORBIC ACID (VITAMIN C), BETA-CAROTENE, TOCOPHEROL (VITAMIN E), MAGNESIUM PHOSPHATE, NIACINAMIDE (VITAMIN B3), THIAMIN HYDROCHLORIDE (VITAMIN B1), RIBOFLAVIN (VITAMIN B2), AND PYRIDOXINE HYDROCHLORIDE (VITAMIN B6).

Contains 42% Juice
Consumers have been waiting a long time for a zero calorie, all-natural sweetener that doesn't sacrifice great taste.

Stevia is the answer.
Stevia (formally known as Stevia Rebaudiana Bertoni) is a plant in the Chrysanthemum family, native to Brazil and Paraguay. Stevia extracts have been used as natural sweeteners and herbal remedies for hundreds of years.

Stevia Facts:
- Stevia contains no carbs or calories.
- Reb A (Rebaudioside A) is an extract from the stevia leaf.
  - It is 200 times sweeter than sugar, but has zero calories.
  - It is the purest stevia extract on the market today.
- Stevia was approved in the US by the FDA in 2008 and is now widely accepted as a sweetener for a variety of foods and beverages.
- Stevia is now also approved for use in European markets, as well as other markets around the world, such as Japan, Australia and Brazil.
Challenges:

- Technically achievable (c. 5-6 SEV)
- Requires acid /flavour /sweetness modifications
- Natural flavour optimizer to assist with deficiencies in profile
- SOS: Sensory Optimising System
  - www.taste-sos.com
Profiling of Stevia Sweetened Apple 50% Juice Drink

Generated by Sensory Dimensions
Profiling of Optimised Stevia Sweetened Apple 50% Juice Drink

Generated by Sensory Dimensions
Evolution of Products
Evolution of beverages

- 30% calorie reduced
- Lower sugar
- Minimal trumpeting
Evolution of beverages
Coke Life
Proposition?

- 30% lower calories
- 30% less sugar
- Natural sweeteners
- Not regular Cola...
Pepsi Next

- Mid Calorie (60 per can), No aspartame
- Different offerings in different markets
- In some markets it is sweetened with high fructose corn syrup, sugar, acesulfame potassium, and sucralose

- Finland, the Netherlands and Australia,
- Pepsi Next is
  - Sweetened with stevia
  - Has no artificial sweeteners
  - 30% less sugar
Pepsi True: too good to be true???

Available on line at Amazon...
Zevia

- New Brand
- All about natural and no added sugar
- Zero calories
- Launched 2007
- $60m brand in 2013
Zevia

- Blended sweeteners
- Blended Acids
- Flavour optimisation
Yogurts

Danone Early Adopter

Natural sweetener is a good fit
Tomato Ketchup

40% fewer calories
50% fewer sugars
No artificial sweeteners

Only mention of stevia in ingredients list
Chocolate

No added sugar
Sweet and Healthy?

- **Ingredients:**
  - cocoa mass, alimentary fibres (dextrin, inulin, oligofructose), sweeteners (erythritol, steviol glycosides), cocoa butter, emulsifier: soy lecithin, natural vanilla flavour. Cocoa solids: minimum 55%.

- No glucose, granulated sugar or fructose

- Inulin, fibres and erythritol for bulk
Ice Cream
Sweet and Healthy?

• Belgium-based Just Ice offers Ice Crime in four flavors: Chocolate, Mocha, Strawberry and Vanilla.

• The stevia-sweetened ice cream contains 30% to 40% fewer calories than regular ice cream.

“wow, they killed the sugar.”
Dairy Drinks

Post Goodness™
Breakfast/Anytime Shake-To-Go

- NO ARTIFICIAL FLAVORS, COLORS OR SWEETENERS
- 170 CALORIES
- 3g FIBER
- 15g PROTEIN
- AN EXCELLENT SOURCE OF PROTEIN

DUTCH chocolate
NATURALLY FLAVORED

4 PACK - 11 FL OZ (325mL) SHAKES • NET 44 FL OZ (1.3L)
USA

- Goodness-To-Go breakfast shakes
- Dutch Chocolate, Mocha and Tahitian Vanilla
- Free from artificial flavours, colours and sweeteners.

- Sweetened with:
  - agave,
  - monk fruit
  - stevia

- 170 calories per 325ml single-serve (340 for an equivalent full sugar version)
Care please....

- Stonyfield smooth and creamy style non fat yogurts replaced some of sugar- with organic stevia

- Consumers did nor want their product ‘messed with’

- Now reverted to sugar
Care please....

- Glaceau Vitamin water reformulated with stevia in US
- Now reverted to sugar
FUTURE
Monk Fruit / Lo han guo

- Extracted from Chinese longevity fruit
- Botanical Name: *Siraitia grosvenorii*
- Sweet triterpene glycosides known as mogrosides
- Approximately 250 times as sweet as sugar
- Late onset of intense sweetness with some additional flavours
- Currently approval in several territories including Japan and USA.
Monk Fruit / Lo han guo

• Regulatory hurdles
• Good sweetness quality without bitter/liquorice aftertaste
• Stable to pH and to high temperature processing such as pasteurisation
• Readily soluble and easy to use
• Fruit extract very positive association for consumers
• Label declaration?
  • Mogroside equivalents?
Erythritol

- Regulatory hurdles
- Extension to beverages @ 1.6%
- Improve mouthfeel and sweetness quality
NEXT ...
Immediate future: ingredients

- Stevia and carbohydrates/ fibres/ flavour optimisers
- Many grades to evaluate determine best fit with your product
- Taste optimization key (acids/ flavours)
- Potentially more choice in the future
Immediate future: Opportunities

- Remember the consumer with the proposition
- Dairy
  - Drinks
  - Yogurts
- Fruit juices
  - Reduced sugar
- Beverages
  - New propositions
Thank you for your attention

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