Role of Stevia in Health & Nutrition

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India - April 13th, 2016
Overview

- Global Stevia Institute
- History of Stevia
- Global Health Indicators
  - India
- Role of Stevia in
  - Healthy Lifestyle, Overweight/Obesity, & Diabetes
- Stevia safety
- Practical Implications for the Diet
- Conclusion
Mission & Supporting Values

Mission
To advance and share leading, balanced, science-based information about stevia that helps educate science and nutrition communities, as well as consumers globally.

Scientific Truths
Scientific truths are always the basis for information that the GSI provides. Science is the lens, with the recognition some audiences require an emotional input.

Transparency
Being transparent in all our efforts is of the upmost importance for maintaining our credibility. To do so we communicate in an open and honest way with our audiences from partners to consumers.

Working Together
To further enhance awareness and education of stevia, GSI partners with companies and organizations throughout the world to support stevia advocacy efforts.
WHAT DOES GSI DO?

The Global Stevia Institute is committed to:

- Providing credible and accurate information about stevia
- Fostering interactive dialogue and education about stevia through symposia, webinars and training workshops
- Developing educational resources and tools on stevia science
- Facilitating and support cutting edge stevia research.
GSI: Promoting science-based information about stevia to health professionals, consumers and the food industry

Guided by Scientific Advisors from around the world who, also serve as advocates for stevia’s science education

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The GSI is supported by PureCircle, Ltd, a global leader in purified stevia leaf extract production.
A Little Bit of History

Centuries Ago
The plant stevia rebaudiana was first discovered by indigenous people who used the plant’s leaves to sweeten drinks.

By the 1800s
Stevia consumption was established throughout South America. Dr. Bertoni discovered stevia in Paraguay.

1931
Two French chemists isolated the components (steviol glycosides) that give stevia its characteristic sweet taste.

1977
Japan began using stevia as a sweetener in foods and beverages.

2008-2010
High purity Rebaudioside A earned Generally Recognized as Safe status under the laws administrated by the U.S. FDA, allowing it to be used in foods and beverages & Food Standards Australia New Zealand also approved steviol glycosides.

2011
The European Food Safety Authority approved the use of steviol glycosides as a sweetener in foods and beverages.

2015
The Food Safety Standards Authority of India approved the use of steviol glycosides as a sweetener in foods and beverages.

Stevia is now approved in more than 100 countries around the World.
Stevia: Simple plant, but fancy components

**Steviol glycosides:**

- All have steviol backbone
- Most have at least one glucose unit
- Some have additional sugar units (rhamnose, xylose)
- Rebaudioside A is the most prevalent sweet compound (steviol glycoside) in the leaf
  - A 95% purity Reb A was the first to be launched commercially after regulatory approval
### Steviol Glycosides: 30+ Identified in the Stevia Plant

Nine - Eleven* approved by regulatory bodies to date

<table>
<thead>
<tr>
<th>Steviol glycosides</th>
<th>Sweetening power relative to sucrose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stevioside</td>
<td>150-300</td>
</tr>
<tr>
<td>Rebaudioside A</td>
<td>200-400</td>
</tr>
<tr>
<td>Rebaudioside B</td>
<td>300-350</td>
</tr>
<tr>
<td>Rebaudioside C</td>
<td>50-120</td>
</tr>
<tr>
<td>Rebaudioside D</td>
<td>200-300</td>
</tr>
<tr>
<td>Rebaudioside E</td>
<td>250-300</td>
</tr>
<tr>
<td>Rebaudioside F</td>
<td>Na</td>
</tr>
<tr>
<td>Rubusoside</td>
<td>110</td>
</tr>
<tr>
<td>Steviolbioside</td>
<td>100-125</td>
</tr>
<tr>
<td>Dulcoside A</td>
<td>50-120</td>
</tr>
<tr>
<td>Rebaudioside M*</td>
<td>300-600</td>
</tr>
</tbody>
</table>

*Reb M: Canada, U.S. and Australia
Why Stevia? & Why Should we Care?
1.9 Billion
Of the World’s Population
Overweight or Obese,
42 Million
Children <5y
39%
Adults Overweight

Some of the Most Challenging Health Problems of the 21st Century

415 Million
Adults Worldwide have Diabetes,
642 Million
By 2040

http://www.who.int/mediacentre/factsheets/fs311/en/
http://www.diabetesatlas.org/ 7th edition
India - 2015: About 1 in 3 Adults 30+y are Overweight

WHO; Impact of chronic disease in India, 2015
India: Urban & Rural
Prevalence of Generalized, Abdominal & Combined Obesity in 4 Regions of India; ICMR-INDIAB Study

India: 2\textsuperscript{nd} Highest Number of Diabetic Adults & Children & Additional 36.5 Million Adults with Impaired Glucose Tolerance that will double by Year 2040

### Year 2015 Adults: Top 10 Countries

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Value (Millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>China</td>
<td>123.9</td>
</tr>
<tr>
<td>2</td>
<td>India</td>
<td>69.2</td>
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<tr>
<td>3</td>
<td>USA</td>
<td>29.3</td>
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<tr>
<td>4</td>
<td>Brazil</td>
<td>14.3</td>
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<td>Russia</td>
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<tr>
<td>6</td>
<td>Mexico</td>
<td>11.5</td>
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<tr>
<td>7</td>
<td>Indonesia</td>
<td>10</td>
</tr>
<tr>
<td>8</td>
<td>Egypt</td>
<td>7.8</td>
</tr>
<tr>
<td>9</td>
<td>Japan</td>
<td>7.2</td>
</tr>
<tr>
<td>10</td>
<td>Bangladesh</td>
<td>7.1</td>
</tr>
</tbody>
</table>

### Year 2015 Children (0-14y): Top 10 Countries

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Value (Thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>USA</td>
<td>84,100</td>
</tr>
<tr>
<td>2</td>
<td>India</td>
<td>70,200</td>
</tr>
<tr>
<td>3</td>
<td>Brazil</td>
<td>30,900</td>
</tr>
<tr>
<td>4</td>
<td>China</td>
<td>30,500</td>
</tr>
<tr>
<td>5</td>
<td>United Kingdom</td>
<td>19,800</td>
</tr>
<tr>
<td>6</td>
<td>Russia</td>
<td>18,500</td>
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<tr>
<td>7</td>
<td>Saudi Arabia</td>
<td>16,200</td>
</tr>
<tr>
<td>8</td>
<td>Germany</td>
<td>15,800</td>
</tr>
<tr>
<td>9</td>
<td>Nigeria</td>
<td>14,400</td>
</tr>
<tr>
<td>10</td>
<td>Mexico</td>
<td>13,500</td>
</tr>
</tbody>
</table>

IDF Diabetes Atlas, 2015, 7\textsuperscript{th} Edition.

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PREVENTING weight gain is critical

WHO; Impact of chronic disease in India, 2015
What Role can Stevia Sweetener play in Health Lifestyle, Overweight/Obesity & Diabetes?
Recent Meta-analysis on Low-Calorie Sweeteners (LCS) & Body Weight and Composition

Data from 15 RCTs indicate substituting LCS options for their regular-calorie versions showed that it modestly but significantly reduced all outcomes

- Modest weight loss, -0.80 kg
- BMI, -0.24 kg/m2; Fat mass, -1.10 kg; Waist circumference, -0.83 cm
- Adults, Children, Female vs. Male

Miller PE et al., Low-calorie sweeteners and body weight and composition: a meta-analysis of randomized controlled trials and prospective cohort studies, AJCN, June 2014.
Miller PE et al., Low-calorie sweeteners and body weight and composition: a meta-analysis of randomized controlled trials and prospective cohort studies, AJCN, June 2014.
Stevia: Hunger, Satiety & Food Intake
First study to test the effects of stevia on food intake & satiety in humans

- Preloads of Stevia* (290 kcal), & Aspartame (290 kcal) vs. Sucrose (493 kcal)

- Results:
  - No differences in Hunger or Satiety across groups
  - Low-cal participants did not eat more calories at subsequent meals

Stevia is Suitable for People with Diabetes

To date: Neutral affect on blood glucose in Type I & II diabetics (animals & humans)

AIM: To determine chronic/long-term pharmacological effect in Type II diabetic adults
- 16 wk, 1000 mg/d Reb-A (capsules) vs. placebo (N=122), 33 - 75y

RESULTS:
- Contributes to no carb/glycemic load
- Well tolerated
- No effect on glycosylated hemoglobin
- No effect on fasting blood glucose, or insulin

Fig. 2. Mean ± standard error of the mean fasting glucose concentrations (mg/dL) at baseline (average of values at weeks −2 and 0) and 4, 8, 12, and 16 weeks of treatment for subjects receiving rebaudioside A (n = 60) or placebo (n = 52). Error bars are shown above the data points for rebaudioside A and below the data points for placebo.

Stevia Leaf Extract Helps Blunt Blood Glucose Level in a Reduced Calorie Meal

- Consumption of preloads significantly reduced postprandial insulin and glucose levels compared to sucrose
  - Due to the reduced carb & calorie intakes
- Stevia leaf extract help sweeten foods and beverages without all the calories, carbohydrates & sugar a full-calorie, full-sugar food/beverage provides which can help healthy individuals and those with diabetes control—calorie, carbohydrate & sugar intake
Support for the Role of Non-Nutritive Sweeteners

American Heart Association/American Diabetes Association Joint Position, 2012:
“When used judiciously, NNS could facilitate reductions in added sugars intake, thereby resulting in decreased total energy and weight loss/weight control, and promoting beneficial effects on related metabolic parameters.”

Academy of Nutrition & Dietetics 2012:
NNS when substituted for nutritive sweeteners may help consumers limit carbohydrate and energy intake as a strategy to manage blood glucose or weight.
Summary of Stevia’s Benefits for a Healthy Lifestyle, Overweight/Obesity and Diabetes

**Weight Management**
- Foods with stevia may help with a long-term modest effect on body weight, BMI, & waist circumference

**Appetite**
- Foods with stevia help lower total calorie intake, WITHOUT over-consumption later in the day.

**Diabetes**
- Safe and appropriate for diabetics.
- When used to displace sugar, may help benefit blood glucose & insulin levels.
- Ten studies on pharmacological effect: safety confirmed, no effect on glucose homeostasis

**Blood Pressure**
- Long-term* use may have a small blood pressure lowering effect.

Safety
Stevia has a long history of SAFE use in South America

Steviol glycosides: safety confirmed by regulatory authorities around the world prior to approval for use in food & beverages

Comprehensive studies are conducted in multiple species:
- Genetic toxicity, carcinogenicity
- Pharmacokinetics
- Toxicity studies: Short-term, sub-chronic and chronic
- Reproductive toxicity & Teratogenicity (birth defects)
- Human clinical studies

No adverse effects even at levels far higher than typically consumed
No Observed Adverse Effect Level

NOAEL:
- Stevioside: 970 mg/kg body weight/day
- Equivalent to 383 mg steviol equivalents/kg body weight/day

Acceptable Daily Intake (ADI):
- 1% of NOAEL; 4 mg/kg BW/day of steviol equivalents
- Must apply to ALL populations
- Based on purified >95% steviol glycoside content

Absorption, Metabolism & Excretion

What happens to the stevia when we consume it?
Absorption, Metabolism, and Excretion

Result = zero calories

- Steviol glycosides pass through the GI → colon
- Gut bacteria (bacteroides sp) cleave glucose units
- Remaining steviol backbone → Portal Blood → Liver
- In Liver: steviol + glucuronic acid are conjugated
- Steviol glucuronide → Blood → Tissues/Kidneys → Urine

Geuns JMC, et al., 2006, J Agri Food Chem 54
Nutrition and Diet
For the Love of “Sweet”

India’s love for “sweet” and “sugar” goes back 2000+ years
India developed the methods of extraction and purification of sugarcane and sugar is used in India’s colorful cuisine of sweets, beverages and savory dishes

Photo credit: Avik Poddar, Real Bharat Oct2015
Indian Diet: Dietary Recommendations & Sugar Intake

Recommendations on Sugar Intake for Indians (2011)
- #14*, Minimize the use of processed foods rich in salt, sugar and fats.

Where can stevia replace sugar in the Indian diet?
- Beverages: Sweet lassi, fruit drinks, sharbat, milkshakes, soda, etc.
- Main Meals: stuffed roti’s, sweet yogurt, sweet rice dishes, etc.
- Snacks/ Sweets: kulfi, halwa, gulab jamun, puddings, cakes, cookies, kheers, payasams, etc.
- Other: chutneys, pickles, jams, sauces, etc.

*of 15 broad guidelines
Dietary Guidelines for Indians, 2011. NIN
Gulati & Misra, 2014 Nutrients (6); Sugar Intake, Obesity & Diabetes in India
Sugar Consumption in India

Per capita consumption of sugar, jaggery, khandsari and, sugar from sugar sweetened beverages

Gulati & Misra, 2014 Nutrients (6); Sugar Intake, Obesity & Diabetes in India
Sweetness means less Calories & Sugar

- Stevia: NATURALLY up to 350x sweeter than sucrose
- Replace/ reduce sugar either totally or partially
- A target of 100 kcals less daily → ↓ 36,500 kcal / person / year

Example: @ ~300 x sweetness of Sugar
1 tsp (5g) of Reb A can replace 1500 g of Sugar
Expert Consensus Statement on Low/ No-calorie Sweeteners - April 2014

- Help reduce energy intake when they replace high-calorie ingredients.
- Can enhance weight loss under real-life conditions when used as part of a behavioral weight loss program.
- May benefit post-prandial glucose & insulin in both healthy people & those with diabetes.
- Won’t increase appetite, no discernable effect on satiety.
- Have dental benefits when used in food & beverages

In Conclusion - Stevia

• Natural origin zero calorie sweetener
• Has been used in parts of the world for hundreds of years
• Excellent tool for enhancing compliance with low-calorie diets
• Neutral effect on blood glucose, useful for diabetics and healthy lifestyles
• Safe & suitable for whole family – including children & pregnant women
• Tooth friendly
• Useful in both foods and beverages
• Can be part of the solution to addressing global health crises!
For more information on the science of stevia, visit

www.globalsteviainstitute.com

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THANK YOU

धन्यवाद