The 5 Most Common Sweeteners: What Are They?

1. Saccharin
2. Aspartame
3. Acesulfame K
4. Sucralose
5. Neotame

Saccharin:
- Oldest sugar substitute—discovered 1879
- Sweetness around 200 times that of sugar
- Not suitable for those with phenylketonuria (PKU)

Aspartame:
- Discovered in 1971
- Sweeter than 200 times that of sugar
- Not suitable for those with phenylketonuria (PKU)

History of Sugar
- Sugar cane plant first discovered in New World around 1500
- Sugar consumed in pole positions by sugar producing countries
- Sugar was a precursor to the development of the sugar industry
- Sugar became an essential ingredient in the diet

Effects of the Napoleonic War
- In the early 1800s, French sugar supplies were disrupted due to war.
- This led to the development of artificial sweeteners
- Saccharin was introduced as a sugar substitute during the war
- Saccharin became widely used after the war

Industry Development
- Coq2214 had a shortage of sugar and a substitute was sought by combining 0-sulfobenzoic acid with phosphorus chloride
- Cyclamate was introduced through the efforts of a woman in the scientific community
- Aspartame was discovered in 1965
- Neotame was introduced in 1988
- Saccharin was prohibited in the United States in 1976

A Closer Look at Artificial Sweeteners
- Saccharin:
  - Sweetness: 200-700x that of sugar
  - Not suitable for those with phenylketonuria (PKU)
- Aspartame:
  - Sweetness: ~200x that of sugar
  - Suitable for those with phenylketonuria (PKU)
- Acesulfame K:
  - Sweetness: ~200x that of sugar
  - Not suitable for those with phenylketonuria (PKU)
- Sucralose:
  - Sweetness: ~200x that of sugar
  - Not suitable for those with phenylketonuria (PKU)
- Neotame:
  - Sweetness: ~200x that of sugar
  - Not suitable for those with phenylketonuria (PKU)
Acesulfame K
- Discovered in 1967
- Listed as “acesulfame potassium” or “ace-K”
- Exists as a potassium salt
- ~200x sweeter than sugar
- Stable under high temperatures
- Very versatile—used in many kinds of products
- Sold under names: Sunette, Ace-K
- Considered safe by FDA, JECFA, and SCF

Sucralose
- Discovered in 1976
- Derived from sugar (sucrose)—3 hydroxyl groups replaced by chlorine atoms
- ~600x sweeter than sugar
- Most heat-stable sugar substitute
- Sold under name: Splenda

Neotame
- Newest artificial sweetener—approved by FDA in 2002; not widely used yet
- ~8000x sweeter than sugar
- Possesses a clean, sweet taste like sugar
- Similar structure to aspartame; release of phenylalanine during breakdown is reduced

Products Containing Artificial Sweeteners
- Dark chocolate chips
- Sugar alcohols: xylitol, mannitol, sorbitol, lactitol, erythritol
- Ice cream
- Usually contains sucralose (or Stevia)
- “Guilt-free” ice cream

Products (cont.)
- Canned goods
- Sugar substitute that measures/bakes like sugar
- Ideal for diabetics
- Gum
- Xylitol (prevents tooth decay)
- Sorbitol (cheaper than xylitol)

Marketing: Splenda vs. Equal
- Splenda
  - Derived from sugar
  - “Natural”
  - “Tastes like sugar”
  - Misconception: Splenda is sugar but without calories
  - Only sugar substitute that measures/bakes like sugar
- Equal
  - Aspartame (not derived from sugar)
  - Promoted as an artificial sweetener
  - “Sweet, clean taste, like sugar”

“Splenda Essentials”
- New, “improved” version of original Splenda
- Promoted as an artificial sweetener
- “Helps support a healthy metabolismoce“
- “Helps with weight loss”
- Marketed as a weight loss product

“Splenda Essentials” (cont.)
- Splenda Essentials with Antioxidants
  - Consumers made to believe it will offer the same benefits as real fruit
  - “20% daily value of vitamins C & E from real fruit“
  - Marketed with other chemical-synthesized vitamins
“Splenda Essentials” (cont.)
- Splenda Essentials with filler
- Package has pictures of whole grain cereals
- “Small boost of healthy fiber”
- Contains refined corn fiber
- Lumps
- Violations: Consumer Legal Remedies Act
- Violations: Sherman Food, Drug, Cosmetic Law

Foods Containing Artificial Sweeteners
- Tend to also contain masking flavors
- Mask lingering sweetness/bitter aftertaste
- Added acidity (such as citric acid)
- Some food intolerance
- Chemosensates added to increase saliva production
- Reduce bitterness
- Induce cooling/warming effects

Artificial Sweetener Market
- Aspartame: highest global production
- Rising due to safety concerns of sucralose
- Significant demand for sugar alcohols
- Potential to reach $1.5 billion by 2015
- Lack of education:
  - General public does not read food labels
  - Conflicting information on artificial sweeteners

Marketing Strategies
- Nutrition claims:
  - Sweetened to look like to increased vegetable intake
  - Added acidity to increase stickiness
    - “Juicy texture”
  - Added flavors: to satisfy craving
  - Sweeteners aid in weight loss
  - Partner with other healthy project development
  - Same package
  - Splenda and nutrition bars

Physiological Effect & Safety

Sweeteners to Examine:
- Sucralose (Splenda)
- Aspartame (Equal)
- Saccharin (Sweet ‘N Low)
- Neotame (NutraSweet)
- Stevia (Truvia)

Sugar vs. Artificial Sweeteners
- Sucrose = disaccharide
- Energy source from carbohydrate
- “Blood glucose → Pancreas → Insulin → Glucose storage
- Harmful to the gut microbiome:
  - Fungi bacteria such as C. albicans
  - Harmful bacteria such as Lactobacillus rhamnosus
  - Carbohydrate (sugars) contain 4 kcal/g
  - Artificial sweeteners contain (nearly) zero kcal

Single Parenting & Sweetener Use

Splenda
- Splenda contains sucralose
- Top selling packaged sugar substitute—side effects?
- Splenda is not calorie-free?
  - Sucralose is 600x sweeter than sugar; 0% in Splenda
  - Other gums: fiber, maltodextrin (polysaccharide) and dextrine (D-glucose)
  - 4 kcal/serving
More About Sucralose (Splenda)
- Covalently bonded chlorine atoms (C-Cl) as opposed to ionically bonded (Na-Cl)
- Some is excreted via digestive and pulmonary elimination; remainder is stored in adipose tissue (fat soluble)
- Implications for fat storage and release
- Linked to:
  - Headaches, vision problems, allergies, weight gain

Other Artificial Sweeteners
- Saccharin (Sweet ‘N Low) has been linked to weight gain and bladder cancer (similar to aspartame)
- Neotame
  - Nearly identical structure to aspartame
  - Added 3,3-dimethylbutanal to block enzyme responsible for cleaving aspartic acid and phenylalanine
  - Formation of formaldehyde still present
- Stevia (Truvia)
  - Sweet on stevia
  - Overwhelming consensus that stevia is safe

Equal
- Contains aspartame
- Most prevalent artificial sweetener in processed food supply
- Chemical composition:
  - 40% aspartic acid, 50% phenylalanine, 10% methyl ester
- Biochemical and metabolic dangers:
  - Methanol byproduct is different than naturally occurring methanol in fruits/vegetables
  - Formaldehyde accumulation, decreased serotonin, & many others

More About Aspartame (Equal)
- Linked to:
  - Migraines
  - Asthma
  - Leukemia
  - Brain tumors
  - Irritable bowel syndrome
  - Parkinson’s disease
  - Multiple sclerosis
  - Diabetes
  - Cancer metastasis

Exponential increase of artificial sweeteners in the food supply
- FDA has approved recommended daily intakes in the media
- Controversies explored in documentaries, in the news, and online

Obesity Correlated with Sugar Consumption

Diet Soda Popularity

Acceptable Daily Intakes (FDA)
- Aspartame (Equal):
  - 50mg per kg body weight
  - ~18-19 cans of diet soda
- Saccharin (Sweet ‘N Low):
  - 5mg per kg body weight
  - ~10 packets of Sweet ‘N Low
- Sucralose (Splenda):
  - 5mg per kg body weight
  - ~6 cans of diet soda
- Acesulfame K:
  - 15mg per kg body weight
  - ~6 cans of diet soda
- Neotame:
  - 2mg per kg body weight
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<tr>
<th>Where Do We Go From Here?</th>
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<tr>
<td>- Moderation is key!</td>
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<td>- Education of the public is needed!</td>
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<td>- Make healthy choices!</td>
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<th>Get Informed!</th>
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<td>- Various documentaries explore the issue of artificial sweeteners.</td>
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<td>- Children must be taught about the sweeteners in their food, and which foods to avoid.</td>
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<td>- The massive amount of evidence suggests that, when used correctly and in moderation, artificial sweeteners are perfectly safe.</td>
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<td>- However, the correlation between sugar substitute consumption and obesity shouldn’t be dismissed!</td>
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<td>- As a consumer, YOU have the choice to use the knowledge available to make the best decision for yourself.</td>
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