Artificial Sweeteners – A Sweet Spot?

Course Objectives
- List the main sweeteners and artificial sweeteners currently available
- Describe the utility of artificial sweeteners
- Discuss the impact on systemic health of natural and artificial sweeteners
- Define the impact on oral health of natural and artificial sweeteners
- Describe the incorporation of xylitol into patient-centered oral care

Why we like sweeteners
- People are born liking sweetness - innate
- Sensory cue for energy
- Sweet compounds mask unpleasant tastes
- Taste perception varies
- Preferred level of sweetness varies

Nomenclature
- Nutritive or non-nutritive
- Synthetic
- Macronutrient substitutes
- Sugar substitutes, sugar replacers
- Alternative sweeteners
- Natural or artificial

Traditional Sweeteners
Sucrose
- Composed of glucose and fructose
- Disaccharide
- Fructose and glucose are linked by a chemical bond
- Processed sugar cane or sugar beets
Fructose
- Monosaccharide
- Sucrose is 50% fructose
- Added to foods and beverages
- Crystalline
- High fructose corn syrup (42%-55% fructose)
- Synergistic for sweetness with sucrose
Glucose

Impact of Sugars on Health
- Obesity
- Diabetes
- CVD
- Dental caries
**Nutritive Alternative Sweeteners**
- Honey
- Agave nectar
- Maple syrup
- Malt syrup
- Polyols

**Sugar Substitutes**
- Taste substitute for sugar
- Usually sweeter for same or less energy value
- May be ‘high intensity’ sweeteners

**Reasons for use of Sugar Substitutes**
- Weight loss
- Diabetes mellitus
- Reactive hypoglycemia
- Cost
- Dental care

**Non-nutritive Artificial Sweeteners**
- Aspartame
- Acesulfame Potassium
- Saccharin (banned in Canada)
- Neotame
- Sucralose
- Cyclamate (banned in US)

‘Acceptable Daily Intake (ADI)’

<table>
<thead>
<tr>
<th>Sweetener</th>
<th>ADI</th>
<th>Equivalent to</th>
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<tbody>
<tr>
<td>Aspartame</td>
<td>50 mg/kg weight</td>
<td>18 - 19 cans diet soda</td>
</tr>
<tr>
<td>Sucralose</td>
<td>5 mg/kg weight</td>
<td>6 cans diet soda</td>
</tr>
<tr>
<td>Acesulfame K</td>
<td>15 mg/kg weight</td>
<td>6 cans diet soda</td>
</tr>
<tr>
<td>Saccharin</td>
<td>5 mg/kg weight</td>
<td>9 - 12 packets sweetener</td>
</tr>
</tbody>
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**Artificial sweeteners and oral health**
- Noncariogenicity or anticariogenicity?
- Vehicles
- Efficacy and Safety

**Noncariogenic**
- Aspartame
  - Discovered in 1965
  - Odorless white crystals
  - 200x sweeter than sugar
  - Contains phenylalanine and aspartic acid
- Neotame
o Similar to aspartame but 30 – 40 x sweeter
o Contains phenylalanine and aspartic acid

- Sucralose
  o Derived from sugar
  o Chlorination process
  o Combined with maltodextrin for bulk

- Acesulfame-K
  o Taste on own can be bitter
  o Does not affect blood sugar
  o 95% excreted unchanged in urine

- Saccharin
  o First used in 1878
  o Derived from petroleum
  o Organic sulfa-based molecule
  o 300x sweeter than sugar
  o Early (1970s) rat safety study

- Cyclamate
  o Discovered in 1937 in Illinois
  o 30 – 50 times sweeter than sugar
  o Less expensive than most

**Polyols**
- Erythritol
- HSH
- Isomalt
- Lactitol
- Maltitol
- Mannitol
- Sorbitol
- Xylitol

**Xylitol**
- Naturally occurring
- Wood sugar or birch sugar
- A five-carbon sugar alcohol
- Naturally occurring - in the fibers of many fruits and vegetables, including various berries, corn husks, oats, and mushrooms
- Roughly as sweet as sucrose; two-thirds the food energy
- Transported into bacterial cells
- Cannot be metabolized by S. Mutans
- Inhibits enzymes
- Reduces acid production
- Starvation effect
- Use is contraindicated with irritable bowel syndrome

**Anti-cariogenicity of xylitol**
• Two-year study in Finland, 30% to 60% caries reduction in children aged 11-12 with 7 to 10g of xylitol daily in chewing gum
• 40-month study in Belize with chewing gum
• 3-year study in dentifrice, 12% additive caries reduction

Effect of sorbitol

Disease Transmission and Xylitol
• Dental caries is a transmitted infection
• Typically vertical transmission
• Window of infectivity
• Until age 26 months
• S. mutans: 20% by 14 months
• Up to 80% by age 2
• Mother’s status is a predictor
• Use of xylitol

Incorporation of xylitol / artificial sweeteners into patient-centered care
• Disease prevention utility
• Which patients can benefit
  o From artificial sweeteners
  o From xylitol
• Does and frequency
• What vehicle is best?
  o Age and oral status
  o Habits
  o Sensory experience
  o Compliance