Sugars – an historical perspective

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In the beginning...

• God made man and woman in the garden of Eden¹
  - “...I give all the seed-bearing plants...and all the trees with seed bearing fruit; this will be your food.”
  - “…and thorns and thistles it will grow for you, and you must eat the vegetation of the field. In the sweat of your face you will eat bread…”

• Men and women evolved from apes²
  - breast milk
  - fresh fruits
  - honey

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1. Genesis, Chapter 3. The Bible. 5000 (BC).
Honey – our first sweetener

• Common names:
  “Honey”

• Made from:
  ➢ Flower nectar, by bees

• Nutrition at a glance:
  ➢ Sweetener type: Nutritive
  ➢ Sugars: Fructose (38%), glucose (30%), sucrose, maltose
  ➢ Relative sweetness: Equally sweet to about 50% sweeter
  ➢ Calories (kJ): 22 (94 kJ)/level teaspoon

Honey history

• Honey has long been very desirable to humankind
• We have gone to great lengths to obtain it
• How much we ate in the past is difficult to determine as honeycomb does not leave behind a permanent archaeological record
• Modern hunter gatherers provide some insight into what our ancestors may have eaten

Honey in the stone age

• Ancient rock art in the Cueva de la Arana, Spain (10,000 – 8,000 BC) depicts our forebears braving wild bees to steal honeycomb

Honey in the stone age

Anbarra Aborigines of northern Australia

• Average honey consumption over 4×1-mo periods
• Chosen to be representative of the various seasons
• 2 kg per person per year
• ~5.5 g per day
• Native Australian bees do not produce much honey
Honey in the stone age

- Hadza men in Tanzania follow the honeyguide bird to hives hidden in the rocks and trees
- In the wet season (Nov - May), honey provides 63% of energy
- In the dry season (Jun - Oct), honey provides 14% of energy


Honey in the stone age

- Mbuti pygmies of DR of Congo
  - Consumed 80% of energy from honey during honey season
  - 2 months of the year
  - Equivalent to ~13% of energy over a 12 month period


Honey in ancient civilizations

- Ancient Egyptians
  - First bee keepers
  - Records from marriage contract 2000 – 1000 BC
  - 6 – 13 kg / person / year
  - 16 – 36 g / person / day
  - Debate as to whether a luxury item or common household food / ingredient


Honey in ancient civilizations

- China
  - 500 AD
  - Chinese official
  - Quart of honey / month
  - ~19 kg per year
  - 52 g per day

Honey in the middle ages

**England**

- 1300 - 1500 AD
- From scant records (household ledgers), estimated 1 - 5 g/day
- Possible that medieval manors had their own hives and therefore honey did not need to be purchased (like vegetables grown on-site)
- Price of 1.3 pence kg (similar to butter)

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Sugar (honey powder)

- **Common names:**
  “white sugar, white refined sugar, caster sugar, castor sugar, loaf sugar, or cube sugar, icing sugar, coffee sugar, coffee crystals, or raw sugar”
- **Made from:**
  - sugarcane
  - sugar beet
  - various palms
- **Nutrition at a glance:**
  - Sweetener type: Nutritive
  - Sugars: Sucrose
  - Relative sweetness: Equal
  - Calories (kJ): 16 (67 kJ)/level teaspoon

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Honey in the middle ages

**England**

- By the mid 1500s sugar began to usurp honey
- Initially for the very wealthy
- Sugar cane production increased globally
- Extraction technology improved dramatically
- Sugar became the preferred sweetener...

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Sugar in ancient history

**Polynesia / New Guinea**

- Domesticated ~8000 BC
- Spread across Southeast Asia, Southern China, and India.

**India**

- ? before 800 BC
- Developed extraction and purifying technology

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Sugar in ancient history

Europe

- Alexander the Great (356-323 BC)

- Returning troops from India brought back home mysterious “honey powder”.

Arabia

- ~500 AD cultivation and processing reached Persia
- 800-900 AD, Muslim countries in Middle East and countries in Asia adopted sugar production processes from India
- 1000-1400 AD, West Europeans came in contact with sugar during the Crusades

Sugar in the middle ages

New World

- By early 1500s, the Portuguese took sugar cane to the Americas.
- Sugar mills were constructed in Cuba and Jamaica by the 1520s.
- By 1540, there were 800 sugar mills in Santa Catarina Island and 2,000 on the north coast of Brazil, Demarara, etc.
- African slaves provided most of the labour.

Sugar in modern history

Europe

- By the mid-late 1500s, sugar became the preferred sweetener of the wealthy.
- The association with excess added sugar and dental caries was first observed: “in 1598 a foreign visitor remarked of Queen Elizabeth that her teeth [were] black, a defect which the English seem subject from their too great use of sugar”
Sugar in modern history

Europe
- In 1801 the first European beet sugar factory was established in Germany.
- Europe started producing sugar in vast quantities, making it more popular and accessible to the whole population.
- Sugar came to be considered a necessary food ingredient.

http://www.sugarhistory.net


High Fructose Corn Syrup

- Common names: “HFCS, HFCS-55 (drinks), HFCS-42 (baked goods), HFCS-90”
- Made from:
  - Corn + enzymes (amylase and glucose isomerase)
- Nutrition at a glance:
  - Sweetener type: Nutritive
  - Sugars: Fructose, glucose, maltodextrins.
  - Relative sweetness: 120 - 160% as sweet
  - Calories: 16 (67 kJ)/level teaspoon

High fructose corn syrup
- The process for producing high-fructose corn syrup was developed in the USA in 1957 but was not scalable for mass production.
- The industrial production process was developed in Japan from 1965–1970.
- High-fructose corn syrup was rapidly introduced in to many processed foods and soft drinks in the US from around 1975 to 1985, replacing sucrose as the preferred sweetener.
- It is also used to a much lesser extent in Japan.

http://www.sugarhistory.net
Alternative sweeteners

- Saccharin was discovered in 1879 in the USA, but did not become popular until World War 1.
- Xylitol was discovered in 1890 in Germany but was first used in food in Finland during World War 11.
- Aspartame was discovered in 1965 in the USA, and was approved for use in 1981.

Scientific evidence hierarchy

1. Systematic Reviews and Meta-analyses
2. Randomized Controlled Double Blind Studies
3. Cohort Studies
4. Case Control Studies
5. Case Series
6. Case Reports
7. Ideas, Editorials, Opinions
8. Animal research
9. In vitro ('test tube') research

= testimonials
Association or causation?  
1. Strength  
2. Consistency  
3. Specificity  
4. Temporality  
5. Biological gradient (dose response)  
6. Plausibility  
7. Coherence  
8. Experiment  
9. Analogy  

First RCT sugars and overweight/obesity  
• 19 male university students/staff aged 21-44 years  
• Crossover study – high (438 g/day, or ~104 teaspoons of added sugar, or ~50% of E) or low sucrose (10 g/day) diets for 2 × 14 day periods, plus 2 × 14 day washout, as part of a ~14,000 kJ/d diet  
• High sugar intake was associated ↑ weight (1.0 kg), ↑ triglycerides (7 mg/100 mL) and ↑ insulin (15µU/mL at 120 mins).  
• There were no differences in blood cholesterol, glucose tolerance or fibrinolytic activity  

WHO review of sugars and overweight/obesity  
• SLR and meta-analysis of 30 RCTs and 38 cohort studies  
• ↓ intake of dietary sugars was associated with ↓ body weight (0.80 kg, 95% confidence interval 0.39 to 1.21; P<0.001);  
• ↑ sugars intake was associated ↑ weight (0.75 kg, 0.30 to 1.19; P=0.001).  
• Meta-regression showed no evidence of a dose-response association between sugars as a % of E and body weight (0.02 kg, −0.03 to 0.08); P=0.392).  
• Isoenergetic exchange of dietary sugars with other carbohydrates showed no change in body weight (0.04 kg, −0.04 to 0.13).  

WHO review of sugars and dental caries  
• Review of:  
  - RCTs (none identified)  
  - Non-randomised intervention (3 studies)  
  - Observational studies (8 prospective cohort, 20 population and 24 cross sectional)  
• Published between 1950 and November 2011  
• Evidence for an association between sugars (added sucrose in 78% of studies) consumption in adults (5 studies), and children (50 studies).
Sugars in Dietary Guidelines

United States of America
- Nutrition and Your Health: Dietary Guidelines for Americans, 1980, 1985:
  “Avoid too much sugar”
- Nutrition and Your Health: Dietary Guidelines for Americans, 1990:
  “Use sugars only in moderation”
- Nutrition and Your Health: Dietary Guidelines for Americans, 1995:
  “Choose a diet moderate in sugars”

Australia
- Dietary Guidelines for Australians, 1980 :
  “Avoid eating too much sugar”
- Dietary Guidelines for Australians, 1992 :
  “Eat only a moderate amount of sugars and foods containing added sugars”
- Dietary Guidelines for Australians, 2003 :
  “Consume only moderate amounts of sugars and foods containing added sugars”
- Australian Dietary Guidelines, 2013:
  “Limit intake of foods and drinks containing added sugars”
WHO sugars recommendations

Free sugars

Definitions\(^4\):

- ‘added to foods by manufacturer, cook, or consumer, plus sugars naturally present in honey, syrups and fruit juices’.
- This does not include fruit and dairy products such as milk and yoghurt which naturally contain unrefined sugars and are a source of essential nutrients.

2002 Joint WHO/FAO Expert Consultation on Diet, Nutrition and the Prevention of Chronic Diseases\(^5\)

- “The best available evidence indicates that the level of dental caries is low in countries where the consumption of free sugars is below 15-20 kg per person per year. This is equivalent to a daily intake of 40-55 g per person and the values equate to 6-10% of energy intake.”
- “…country specific and community-specific goals for reduction in the amount of free sugars, aiming towards the recommended maximum of no more than 10% of energy intake.”

2015 WHO Guideline: Sugars intake for adults and children.

Recommendations\(^4\):

- In both adults and children, WHO recommends reducing the intake of free sugars to less than 10% of total energy intake (strong recommendation).
- WHO suggests a further reduction of the intake of free sugars to below 5% of total energy intake (conditional recommendation).
Free sugars

Recommendations:\textsuperscript{14}:

- The recommendation to limit free sugars intake to less than 10\% of total energy intake is based on \textit{moderate quality evidence} from observational studies of \textit{dental caries}.

- The recommendation to further limit free sugars intake to less than 5\% of total energy intake is based on \textit{very low quality evidence} ... relationship between free sugars intake and \textit{dental caries}...


10 percent sugars looks like this:

<table>
<thead>
<tr>
<th></th>
<th>Lunch</th>
<th>Dinner</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 slices of hearty whole grain bread</td>
<td>2 ounces (60 g) beef strips</td>
</tr>
<tr>
<td></td>
<td>2 teaspoons olive oil margarine</td>
<td>1½ cups Asian-style stir-fry noodles</td>
</tr>
<tr>
<td></td>
<td>3½ ounces (100 g) canned red salmon</td>
<td>2 cups Asian-style stir-fry vegetables</td>
</tr>
<tr>
<td></td>
<td>½ cup mixed salad (lettuce, cucumber, and tomato)</td>
<td>1 tablespoon sesame oil</td>
</tr>
<tr>
<td>One 7-ounce (200 g) container low-fat vanilla yogurt</td>
<td>½ cup Asian stir-fry sauce</td>
<td></td>
</tr>
<tr>
<td></td>
<td>½ banana</td>
<td>½ cup reduced-fat vanilla ice cream</td>
</tr>
<tr>
<td></td>
<td></td>
<td>½ cup strawberries</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 piece (8 g) milk chocolate</td>
</tr>
</tbody>
</table>

2040 calories (8,400 kJ); 105 g protein; 62 g fat; 16 g saturated fat; 162 mg cholesterol; 250 g total carbohydrate; 104 g total sugars; 50 g added sugars; 25 g fibre; 1742 mg sodium.

sweetness in traditional pop culture

- Poetry from \sim 1820:
  
  “Sugar and spice
  and everything nice
  that's what little girls are made of”

- Valentines day:
  - Richard Cadbury credited with boxed chocolates for gifts in mid 1800’s

- Easter:
  - Cadbury made first commercially successful chocolate Easter egg in 1875

Sweetness in traditional pop culture

Endearment:  
• Honey (bun / pie)  
• Sugar bun / babe  
• Sugar daddy  
• Sweetie / sweetness  
• Honeymoon  
• Cupcake  
• Peaches

Conclusions

• Humans have always consumed sugars  
• Honey was our first "free" sugar and we went to great lengths to obtain it  
• Sugar cane was domesticated 10,000 years ago, and overtook honey as the preferred sweetener in Europe in the 1700's  
• HFCS were invented in the 1960's, commercialised in the 1970's and soon became the preferred sweetener in Nth America  
• Polyols and non-nutritive sweeteners were invented in the late 1800's, and are increasingly popular

Conclusions

• Sugars association with dental caries was noted in the 1500's, and there is good evidence today that free sugars contribute to tooth decay  
• There is now good evidence that added sugars (like other carbohydrates) contribute to weight gain  
• Dietary Guidelines have always told people to avoid / eat less / limit added sugar(s)  
• WHO 2002 guidelines advised people consume ≤10% of E from free sugars and this was reiterated in 2015  
• Sugars were a highly prized spice and a term of endearment for centuries  
• Since the 1970's, they have been increasingly demonised, and became a pariah in the 2000s