Low-calorie sweeteners - recent evidence and its translation in the media

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Outline

• Background
• LCS research and media coverage
• Challenges and opportunities for research
• Summary
Background
Sugar reduction in the UK

- Following ‘Childhood obesity: a plan for action’
- Reduction of sugar content by 20% by 2020
- Suggested strategies
  - Reformulation
  - Reduce energy density and/or portion sizes
  - Change consumer purchasing
- PHE has endorsed the use of low-calorie sweeteners (LCS)
## LCS approved in Europe

<table>
<thead>
<tr>
<th>Intense sweeteners</th>
<th>E-number</th>
<th>Sweetness (^a) (mg/kg/BW)</th>
<th>ADI (^b) (mg/kg/BW)</th>
<th>Year of approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saccharin &amp; its salts</td>
<td>E954</td>
<td>300-500</td>
<td>0-5</td>
<td>1977</td>
</tr>
<tr>
<td>Aspartame</td>
<td>E951</td>
<td>180-200</td>
<td>0-40</td>
<td>1984</td>
</tr>
<tr>
<td>Acesulfame-K</td>
<td>E950</td>
<td>200</td>
<td>0-9</td>
<td>1984</td>
</tr>
<tr>
<td>Cyclamates</td>
<td>E952</td>
<td>30</td>
<td>0-7</td>
<td>1984</td>
</tr>
<tr>
<td>Thaumatin</td>
<td>E957</td>
<td>2000-3000</td>
<td>No ADI</td>
<td>1984</td>
</tr>
<tr>
<td>Neohesperidine DC</td>
<td>E959</td>
<td>1900</td>
<td>0-5</td>
<td>1988</td>
</tr>
<tr>
<td>Aspartame-acesulfame salt</td>
<td>E962</td>
<td>350</td>
<td>See aspartame &amp; acesulfame-k</td>
<td>2000</td>
</tr>
<tr>
<td>Sucralose</td>
<td>E955</td>
<td>600</td>
<td>0-15</td>
<td>2000</td>
</tr>
<tr>
<td>Neotame</td>
<td>E961</td>
<td>8000</td>
<td>0-2</td>
<td>2009</td>
</tr>
<tr>
<td>Steviol glycosides</td>
<td>E960</td>
<td>300</td>
<td>0-4</td>
<td>2011</td>
</tr>
<tr>
<td>Advantame</td>
<td>E969</td>
<td>20000</td>
<td>0-5</td>
<td>2014</td>
</tr>
</tbody>
</table>

\(^a\) Relative to sucrose, \(^b\) Acceptable Daily Intake

Adapted from Logue et al., (2016)
LCS are now ubiquitous …
Acceptable daily intake (ADI)

The amount of a substance “that can be consumed daily over a lifetime without appreciable health risk”

NOAEL, no observed adverse effect level

Logue et al., 2015
Biological fate of commonly used LCS
Acesulfame-k and saccharin

**Digestion/absorption**
- Acesulfame-K
  - Almost entirely absorbed, not metabolised
- Saccharin
  - Approximately 85% absorbed, not metabolised

**Excretion**
- Acesulfame-K
  - Excreted unchanged via urine in 24-hours
- Saccharin
  - Excreted unchanged via urine in 24-48 hours
Biological fate of commonly used LCS

Steviol glycosides

**Digestion/absorption**
Steviol glycosides
Absorbed as steviol following bacterial hydrolysis
Steviol conjugated

**Excretion**
Steviol glycosides
Excreted via urine as steviol glucuronide
Biological fate of commonly used LCS
Aspartame and sucralose

**Digestion/absorption**
- **Aspartame**
  - Broken down to its constituents prior to absorption

- **Sucralose**
  - Approximately 15% absorbed
  - Not metabolised

**Excretion**
- **Aspartame**
  - N/A

- **Sucralose**
  - Primary excretion in faeces
  - Absorbed proportion excreted unchanged via urine
artificial sweeteners can cause cancer
artificial sweeteners that don't cause diarrhea
artificial sweeteners can cause diarrhea
artificial sweeteners cause weight gain
artificial sweeteners can cause weight gain
artificial sweeteners cause diabetes
artificial sweeteners can cause diabetes
artificial sweeteners cause stomach pain
artificial sweeteners cause diarrhea
artificial sweeteners cause upset stomach
Diet debate: Are diet drinks a no-go?

By James Gallagher
Health editor, BBC News website

4 January 2017

Cancer and premature birth fears inked to fizzy drink sweetener

SEAN POLLOCK FOR THE DAILY MAIL
UNPUBLISHED: 09:44, 9 March 2013
UPDATED: 13:22, 9 March 2013

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DON'T MISS

The Daily Mail

Trust me, I'm a Doctor

20% off school uniforms

Why low-calorie sweeteners may actually make you FATTER: Sugar substitutes may trigger our bodies to gain extra pounds

20% off school uniforms

M&S
Spend it Well

Two diet drinks a day could double the risk of diabetes, study finds

Two diet drinks a day could double the risk of diabetes, study finds

The Telegraph

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Could artificial sweeteners make people more hungry?

13 July 2016
Health

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The Telegraph
The science

Study design: Prospective cohort study
Population: n = 59,334 pregnant woman
Exposure measures: SSB and ASB
Duration: 6 years
Main findings: ASB (carbonated and non-carbonated) but not SSB associated with preterm delivery
Conclusions: Aspartame may have a role to play. Further studies required to confirm or reject the findings

Media reporting

SSB, sugar-sweetened beverages; ASB, artificially sweetened beverages

Haldorsson et al., 2010
LCS linked with stroke and dementia

The science
Study design: Prospective cohort study
Population: n = 2888 > 45 years (incident stroke) and n = 1484 > 60 years (incident dementia)
Duration: 10 years
Exposure measures: SSB and ASB
Main findings: ASB but not SSB associated with ischemic stroke; no association between ASB or SSB with dementia after adjustment for risk factors.
Conclusions: Potential reverse causation acknowledged. Further research required.

SSB, sugar-sweetened beverages; ASB, artificially sweetened beverages

Pase et al., 2017
Challenges in LCS research

1. Reliable intake/exposure assessments are required
   - Observational studies - comprehensive and specific intake data
   - Intervention studies - compliance to the intervention

2. Cognitive influences of LCS-use need to be explored further

3. Effective communication of the scientific evidence required
   - Healthcare professionals
   - The public
Future opportunities

Reliable intake/exposure assessments

• A biomarker approach?

1. Acesulfame-K
2. Saccharin
3. Cyclamate
4. Sucralose
5. Steviol glucuronide

• ANSES suggest well designed questionnaires

Alternative methods should be **comprehensive** and **specific**

ANSES, French Agency for Food, Environmental and Occupational Health and Safety, 2015
Challenges
Cognitive influences of LCS-use

Is this the case in LCS research?

Real-world: the choice of LCS-products is often an active process

Does blinding remove a potential influencing factor?
Challenges
Effective communication of the scientific evidence

“in the last decade.......we are seeing far less fact driven and analytically driven analysis of policy”

Ernest Moniz
US Secretary of Energy 2013-2017

• Can LCS evidence be communicated more effectively?
  • Safety aspects
  • Health aspects
Summary

Safety of LCS is stringently assessed prior to approval

Some current research approaches have limitations
  • Intervention studies - to better reflect ‘real-world’ scenarios
  • Observational studies - comprehensive and specific intake/exposure assessments

More effective communication of the evidence required
  • Multiple stakeholder involvement
  • Food labelling?
Thank you for listening

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@C1Logue