Human Appetite for Sweetness and Weight Management
a focus on recent data illustrating the role of low-energy sweeteners

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From early life, people like sweetness
Facial expressions of newborn infants Steiner, 1977

Sweetness in the “obesogenic” world
Sweetness is a very potent psycho-biological stimulus that contributes to the palatability of numerous foods and drinks

Sweet tasting stimuli
- Sugars
  - Glucose, fructose, sucrose, maltose
- Polyols
  - Maltitol,
- “Low calorie” sweeteners
  - Saccharin, sucralose, cyclamate, aspartame, thaumatin, stevia

All bind to and activate T1R2+T1R3 receptors (tongue, mouth, gut)
Non-nutritive sweeteners, appetite, satiety and intake

• Non-nutritive sweeteners make it possible to uncouple the pleasant sweet taste from the energy load (4 kcal/gram)

• Theoretically, this might be a good idea, as it could allow consumers to enjoy their preferred sweet foods without the energy intake associated with sugars

• In fact, a few questions have to be asked:
  – Will this affect energy intake? In what direction?
  – Will this affect body weight control?
  – Can this exacerbate the appetite for sweet-tasting substances?

This is a complex issue addressed by research of past 30 years

How can low calorie sweeteners affect appetite and satiety?

A few often expressed fears:

• Sweeteners are useless or dangerous because:
  – They make you hungry.
  – They do not satiate as well as sugar
  – They make you eat too much
  – They induce addictions
  – They contribute to the obesity epidemic

• What have we learned from scientific research over the last 25+ years?

Safety Concerns

• Sweeteners under continuous scrutiny by national and international food safety agencies
  – EFSA
  – AFSA
  – FDA

  Considered safe for use in human nutrition
Potential benefits in terms of appetite and weight control?

Focus on Recent Literature

Observational Studies

Use of low energy sweeteners often associated with

- higher BMI (reverse causality)
- better diet (lower intake of sugar and energy)

Various methodological approaches:

- Animal Models
- Observational studies
- Experimental studies
- Systematic Reviews
- Meta-Analyses

Do diet soda consumers have poorer diets?

The American Multi-Ethnic Study of Atherosclerosis 2009

Is diet soda a marker for an unhealthy lifestyle and/or dietary pattern that collectively leads to metabolic dysfunction?

No

In the MESA study (N = 5316), diet beverage consumers ate more whole grains, fruit, low-fat dairy products, desserts, and coffee but less high-fat dairy products, processed meat, refined grains, and sugar-sweetened soda.

These dietary patterns that have been independently associated with a lower risk of metabolic syndrome or type 2 diabetes.

Experimental Trials

A randomized controlled trial: the CHOICE study
Piernas et al 2013

- 210 adults (BMI = 35 kg/m²) replaced their sweet beverages by either
  - Water
  - «Diet» drinks
  - For 6 months
- Hypothesis: daily intake of diet drinks will stimulate consumption of sugar-containing foods

Results

- Same decrease in daily energy intake in both groups
- Same changes in body weight
- Participants in «diet» drink group ate less
  - Desserts
  - Sugar
- Results opposite to hypothesis

A double-blind randomized trial in school children

de Ruyter et al (2013)
**METHODS and RESULTS**

- Children 4-11 years old (mostly normal weight)
- Over 18 months, 641 children drink either a sugar sweetened beverage daily (104 kcal), or a non-nutritive sweetener beverage:
  - Lower weight gain in sweetener group
  - No increase in liking for sweetness in sweetener group

**Non-nutritive Sweetened Beverages and Weight Loss during a 12-week program**

Peters et al 2014

- Randomised Controlled Trial
- 303 men and women on same diet
- With or without sweeteners

**Does low-energy sweetener consumption affect energy intake and body weight?**

A systematic review, including meta-analyses, of the evidence from human and animal studies.

Rogers et al, Obesity 2015

- 90 Animal studies
- 12 Prospective cohort studies (n>500, follow-up > 1 year)
- Short-term (≤ 1 day) randomized controlled trials (129 comparisons of sweeteners versus sugar, water or nothing) in children and adults
- Sustained randomized controlled trials (10 comparisons) in children and adults

**Conclusions from Rogers et al 2015**

- “Considerable weight of evidence in favor of consumption of low energy sweeteners in place of sugar as helpful in reducing relative energy intake and body weight”
- “Importantly, the effects of low energy sweetened beverages on body weight also appear neutral relative to water, or even beneficial.”
Conclusions

- Over 25 years of research about low calorie sweeteners: observational studies and randomized controlled trials, children, adults, short-term, long-term

- No confirmation that low calorie sweeteners might exacerbate appetite (liking, wanting, ingesting) for sweet products or induce loss of control over eating.

- The evidence rather suggests a decrease in appetite for sweet products

- Effects on appetite may be one mechanism contributing to the weight reducing effects of low calorie sweeteners