

# IUNS 21<sup>st</sup> ICN International Congress of Nutrition “From Sciences to Nutrition Security”



Sociedad Argentina de Nutrición



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# **Sweet taste and Implications with Low-Calorie Sweetener Use**

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# Disclosure of interests

- **Scientific Advisory Committees**

  - Cereal Partners Worldwide

  - Creabio

  - European Fruit Juice Association

  - General Mills

  - International Sweeteners Association

  - Nomad Foods

- **Travel and Speaking Honoraria**

  - ILSI

  - Mars

  - Mondelez

  - Tate & Lyle

# Sweetness and sweeteners in the scientific literature:

## Two aspects

- Sweetness as a very potent  
bio-psychological stimulus  
(what is so special about sweetness?)
- The role of Low-calorie Sweeteners
  - Recent science about potential benefits and risks
  - The potential benefits in everyday life

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# Sweetness and the Human Consumer



# Why is such an innate response present?

## Selected by Natural Evolution

- Survival advantage when the young spontaneously accept sources of energy (mother’s milk, fruits, etc.)
- Genetic basis shared with many other species

(Mennella et al 2005; Savage et al 2007)



# Later in life...

**Early appetite for sweetness decreases with age (in parallel with growth)**

A phenomenon also observed in other mammals

**Large inter-individual differences in taste for sweetness**

influenced by

- genetics,
- ethnicity,
- individual food experiences (family, culture)

**No difference in preferred intensity based on body weight.**



# How Can Low-Calorie Sweeteners Affect Appetite and Satiety?



# An old idea...

J.E. Blundell, P.J. Rogers and A.J. Hill.

Uncoupling sweetness and calories: Methodological aspects of laboratory studies on appetite control. *Appetite* 11 (suppl 1), 54-66, 1988

	<b>Sweetness</b>	<b>Calories</b>
<b>Sugar</b>	Yes 	Yes
<b>Intense sweeteners</b>	Yes 	No

# Sweeteners and Appetite

- **Low-calorie 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, many important questions have to be asked:**
  - **Will this really affect energy intake? In what direction?**
  - **Will this affect body weight control?**
  - **Can this exacerbate the appetite for sweet-tasting substances?**
- **40 years+ research culminating in meta-analyses**

REVIEW

Open Access



# Health outcomes of non-nutritive sweeteners: analysis of the research landscape

Szimonetta Lohner<sup>1</sup>, Ingrid Toews<sup>2</sup> and Joerg J. Meerpohl<sup>2,3\*</sup>

## Abstract

**Background:** Food products containing non-nutritive sweeteners (NNSs) instead of sugar have become increasingly popular in the last decades. Their appeal is obviously related to their calorie-free sweet taste. However, with the dramatic increase in their consumption, it is reasonable and timely to evaluate their potential health benefits and, more importantly, potential adverse effects. The main aim of this scoping review was to map the evidence about health outcomes possibly associated with regular NNS consumption by examining the extent, range, and nature of research activity in this area.

**Methods:** We systematically searched Ovid MEDLINE, EMBASE and the Cochrane CENTRAL databases for studies on NNSs (artificial sweeteners or natural, non-caloric sweeteners, either used individually or in combination) using text terms with appropriate truncation and relevant indexing terms. All human studies investigating any health outcomes of a NNS intervention or exposure were eligible for inclusion. No studies were excluded based on language, study design or methodological quality. Data for each health outcome were summarized in tabular form and were discussed narratively.

**Results:** Finally, we included 372 studies in our scoping review, comprising 15 systematic reviews, 155 randomized controlled trials (RCTs), 23 non-randomized controlled trials, 57 cohort studies, 52 case-control studies, 28 cross sectional studies and 42 case series/case reports.

In healthy subjects, appetite and short term food intake, risk of cancer, risk of diabetes, risk of dental caries, weight gain and risk of obesity are the most investigated health outcomes. Overall there is no conclusive evidence for beneficial and harmful effects on those outcomes. Numerous health outcomes including headaches, depression, behavioral and cognitive effects, neurological effects, risk of preterm delivery, cardiovascular effects or risk of chronic kidney disease were investigated in fewer studies and further research is needed. In subjects with diabetes and hypertension, the evidence regarding health outcomes of NNS use is also inconsistent.

**Conclusions:** This scoping review identifies the needs for future research to address the numerous evidence gaps related to health effects of NNSs use. It also specifies the research questions and areas where a systematic review with meta-analyses is required for the proper evaluation of health outcomes associated to regular NNSs consumption.

**Keywords:** Non-nutritive sweetener, Artificial sweetener, Aspartame, Saccharin, Stevia, Diabetes, Cancer, Dental caries, Weight gain, Overweight, Obesity, Scoping review

A recently published  
systematic review  
commissioned by the  
**WHO (September 2017)**

**No conclusive evidence  
for increased risk of  
disease or weight gain**

**No consistent evidence for  
beneficial effects**

**More research needed**

# Why are there no « consistent » benefits?

- **The overall benefit in terms of energy intake and weight is modest**  
(less than 1.75 kg in the Rogers et al Review )
- **It is easy to miss it**  
(low N, short duration, confounders, noise)
- **What other factors?**

**Who is likely to benefit from  
the use of  
low-calorie sweeteners?**

**Under what conditions?**

# **Importance of the food/drink context**

## **(change in energy density)**



# A few examples

<b>Product (100 g)</b>	<b>Sugar containing (kcal)</b>	<b>With low-calorie sweeteners (kcal)</b>
<b>Sodas</b>	<b>40</b>	<b>2</b>
<b>Fruit drink</b>	<b>56</b>	<b>11</b>
<b>Low fat yoghurt</b>	<b>75</b>	<b>44</b>
<b>Chocolate</b>	<b>513</b>	<b>510</b>

# Low-calorie sweeteners in drinks

- **Sugar can be totally replaced by low-calorie sweeteners in drinks so that the final mass of the drink is water (for example in sodas)**



- **This represents a large difference in energy content**
- **Low level of compensation for the “missing” energy**

# Low-calorie sweeteners in solid foods

- **Low-calorie sweeteners can replace sugars in solid foods in order to maintain the pleasant sweet taste.**
- **The energy content and energy density of the final product depend on its actual composition. It might not be very different from the original sugar-containing product.**
- **Therefore, there is little reason to expect energy intake to be affected in a significant way**



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Guideline:

## **Sugars intake for adults and children**

### **Recommendations**

#### **“Free” Sugars**

**< 10% daily energy  
(weight control)**

**< 5 % daily energy  
(dental health)**

# Energy balance and its components: implications for body weight status

KD Hall et al, AJCN 2012

- **3500 kcal permanent reduction to lose one pound of body weight: inadequate, over-optimistic rule of thumb**
- **100 kcal/day permanent reduction in EI will lead to loss of**
  - About 2,4 kg in one year
  - About 4,5 kg in 3 years
  - About 5 kg in 5 years
- **100 kcal reduction in sugar calories can be obtained using LCS in**
  - 265 ml soda (minimal compensation)
  - 322 g lean yoghurt (moderate compensation)
  - No hope with chocolate

# What can the food and drink industry do to help achieve the 5% free sugars goal?

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**Paper published in  
Perspectives in  
Public Health  
2017**

**In the UK, large  
Intake of sugar**

**Multiple strategies  
recommended**

**The main one:  
Replace sugars with  
Low Energy  
Sweeteners**

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## Abstract

**Aims:** To contribute evidence and make recommendations to assist in achieving free sugars reduction, with due consideration to the broader picture of weight management and dietary quality.

**Methods:** An expert workshop in July 2016 addressed options outlined in the Public Health England report 'Sugar reduction: The evidence for action' that related directly to the food industry. Panel members contributed expertise in food technology, public health nutrition, marketing, communications, psychology and behaviour. Recommendations were directed towards reformulation, reduced portion sizes, labelling and consumer education. These were evaluated based on their feasibility, likely consumer acceptability, efficacy and cost.

**Results:** The panel agreed that the 5% target for energy from free sugars is unlikely to be achievable by the UK population in the near future, but a gradual reduction from average current level of intake is feasible. Progress requires collaborations between government, food industry, non-government organisations, health professionals, educators and consumers. Reformulation should start with the main contributors of free sugars in the diet, prioritising those products high in free sugars and relatively low in micronutrients. There is most potential for replacing free sugars in beverages using high-potency sweeteners and possibly via gradual reduction in sweetness levels. However, reformulation alone, with its inherent practical difficulties, will not achieve the desired reduction in free sugars. Food manufacturers and the out-of-home sector can help consumers by providing smaller portions. Labelling of free sugars would extend choice and encourage reformulation; however, government needs to assist industry by addressing current analytical and regulatory problems. There are also opportunities for multi-agency collaboration to develop tools/communications based on the *Eatwell Guide*, to help consumers understand the principles of a varied, healthy, balanced diet.

**Conclusion:** Multiple strategies will be required to achieve a reduction in free sugars intake to attain the 5% energy target. The panel produced consensus statements with recommendations as to how this might be achieved.



# Conclusions

## **No « magic effect » on energy intake and body weight:**

- **Substituting sugars by low-calorie sweeteners does not necessarily induce a significant change in energy or nutrient content of foods; if there is no effect on energy intake, then no effect on weight can be expected**
- **In drinks and semi-liquid foods, low-calorie sweeteners allow a substantial difference in energy density: only partial “compensation” for the energy substituted has been observed (best results in heavy drinkers of sodas?)**
- **Low-calorie sweeteners are not THE response to obesity but can be viewed as a tool that can be used in a strategy of body weight control: they facilitate modest weight loss and can improve compliance with dietary program over long-term.**

# Future Research Needs

- **Look beyond meta-analyses**
- **Identify conditions of potential benefit in individual users (profile of users; profile of products)**
- **Identify potential extent of benefit**
  - and propose complementary measures of body weight control
- **Explore potential benefit in terms of long term prevention of weight gain**