INTERNATIONAL SWEETENERS ASSOCIATION

SPEAKER ABSTRACTS

Emeritus Prof. A.G. Renwick

Why we can be confident that low-calorie sweeteners are safe?

All low-calorie sweeteners are subject to comprehensive safety evaluation by regulatory authorities, prior to approval. Definitive independent information on the safety of sweeteners can be obtained from the websites of the European Food Safety Authority (EFSA), the European Scientific Committee on Food (SCF) and Joint WHO/FAO Expert Committee on Food Additives (JECFA).

The safety testing of food additives involves *in vitro* and *in vivo* studies in animals to determine what effects the compound is capable of producing when administered at high daily doses, or high dietary concentrations. The studies cover all life phases, including *in utero* and lactation. The dose levels are usually very high because a primary purpose of animal studies is to find out what effects the compound can produce on the body irrespective of dose level (hazard identification). The highest level of intake that does not produce any adverse effects, the no-observed adverse effect level (NOAEL), is used to establish a human intake with negligible risk, which is called the acceptable daily intake (ADI). The ADI is usually calculated as the NOAEL (in mg/kg body weight per day) divided by a 100-fold safety factor, which is to allow for possible species differences and human variability. Data from studies in humans are usually available and can be used to compare the metabolic fate of the compound in the test species and in humans.

The levels of each sweetener that are permitted in different foods and beverages are established so that even high intakes from all sources do not exceed the corresponding ADI value. Extensive intake surveys have shown that the average daily intakes of all low-calorie sweeteners are well below the relevant ADI values.

Low-calorie sweeteners are often added to foods and drinks as mixtures or blends. The only property that is common to all low-calorie sweeteners is their activity at the sweet-taste receptor. They do not share similar metabolic fates or high-dose effects, and no interactions would arise if different low-calorie sweeteners are consumed in a blend.

Low-calorie sweeteners are among the most extensively studied of all food additives. Despite this, the media continue to run stories about “health concerns”, largely related to the adverse effects produced in animals at intakes above the NOAEL, i.e. at >100-times the ADI. Such scare stories usually totally ignore dose-response relationships, the relevance to humans of the effects observed, and the safety factor used to derive the ADI.

Dr Joris Van Loco

How much do we really consume? An ADI case study of Belgian consumers

Based on EC regulation 1333/2008, each member of the European Union is supposed to evaluate the intake of food additives by its population. This project resulted in a demand of the Federal Department of Public Health, Safety of the Food Chain and Environment to the Scientific Institute of Public Health to elaborate a study of table-top sweeteners and the estimation of the total intake of sweeteners by the Belgian population.

The use of the selected sweeteners, including acesulfame-K, saccharin, cyclamate, aspartame and sucralose, is regulated by the European directive on sweeteners (94/35) and for each substance an acceptable daily intake (ADI; acceptable daily intake) was established (9, 5, 7, 40 and 15 mg per kg body weight). The purpose of this study was to establish whether the Belgian adult population was at risk of exposure to sweetener levels that exceeded ADI levels by usual intake of sweetened foods and specific consumption of table top sweeteners.

At first, a conservative approach (TIER 2) was conceived in which national consumption data (available from the food consumption survey) were combined with authorized levels of sweeteners. It was found that average intake for the population is significantly lower than ADI levels. Even consumers with high intakes were not exposed to excessive levels, as seen from relative intake (expressed as % of ADI) for the 95th percentile (p95); acesulfame-K: 31%, aspartame: 13%, cyclamate: 30%, saccharin: 17%, and sucralose: 16%. After the TIER 2 approach, analytically determined concentrations, obtained after sampling of a representative number of foods and table sweeteners, were implemented in the consumption data to estimate a realistic TIER 3. For saccharin and cyclamate, intake was comparable to results from the TIER 2 approach (saccharin: 11% and cyclamate: 25% for consumers with high intakes, i.e. p95). Acesulfame-K (17%), aspartame (5%) and sucralose (7%) (p95 for consumers) produced lower intakes in the TIER 3 estimate and confirmed the conservative nature of the TIER 2. Comparison of average intake of the total population compared with diabetics (acesulfame-K: 3.55 vs. 3.75, aspartame: 6.77 vs. 6.53, cyclamate: 1.97 vs. 2.06, saccharine: 1.14 vs. 0.97, and sucralose: 3.08 vs. 3.03, expressed as mg per kg body weight per day for p95) shows that diabetics are not more exposed to sweeteners. The contribution of table-top sweeteners to the total usual intake (<1% of ADI) was negligible.

It was concluded that neither consumers with high intake nor diabetics surpassed the established ADI for sweeteners; hence the risk that the Belgian adult population is excessively exposed to sweeteners is absent.

Mr Ewan Currie

Sweeteners: Facts & Fiction

There are many opinions about low calorie sweeteners, their role in the diet, consumers' attitudes and the popularity of low calorie foods and drinks. Scientific studies, consumer research and market data show that low calorie foods and drinks play a useful role in helping people maintain a healthy body weight, and that people choose and enjoy these products.

This presentation will discuss some of the misconceptions about sugar and about low calorie sweeteners. It will address the rumours that are spread on the internet, look at evidence from consumer surveys and from the questions that people ask, and consider the market environment for low calorie foods and drinks. It will highlight the successful track record of low calorie products and will draw conclusions based on experience.

Prof. John Brewer

Low calorie sweetness and hydration - applications in exercise and sport

This presentation will explore the role of sport and energy drinks in meeting energy and fluid needs before, during and after a range of sports and physical activities, and the impact of dehydration on exercise capacity will be examined. The importance of the concentration of a sports drink in the delivery of energy and fluid will be explored, together with the role of sweeteners, carbohydrates and electrolytes in the regulation of a drink's concentration to ensure optimal rates of fluid and energy absorption during exercise. Data showing the effect of taste on volitional fluid ingestion during exercise will also be presented. Finally, the rationale for participation in exercise programmes will be examined, and the challenge of combating dehydration without consuming excessive calories will be discussed.

Dr Margaret Ashwell

Can low calorie sweeteners help you to lose weight? A systematic review of the scientific studies

Introduction: Strategies to reverse the upward trend in obesity rates need to focus on both reducing energy intake and increasing energy expenditure. The use of low calorie sweeteners as a substitute for sucrose potentially offers one way of helping people to reduce the energy content of their diet without any loss of palatability.

Our systematic review and meta-analysis included the evidence for the effect of aspartame on weight loss, weight maintenance and energy intakes in adults. It addressed the question of how much energy is compensated for and whether the use of aspartame sweetened foods and drinks is an effective way to lose weight.

Methods: All randomised controlled trials in healthy adults which examined the effect of substituting sugar with either aspartame alone or aspartame in combination with other intense sweeteners on energy intake or body weight were identified. A minimum of 24 hours energy intake data was set as the cut-off to ensure that the full extent of any compensatory effects were seen. A total of 16 studies were included in the analysis. Of these 16 studies, 15 had energy intake as an outcome measure and 9 had weight loss. The studies which used soft drinks as the vehicle for aspartame used between 500ml to about 2000ml which is equivalent to about 2 to 6 cans or bottles of soft drinks every day.

Energy intakes: A significant reduction in energy intakes was seen with aspartame compared to all types of control, except when aspartame was compared with non-sucrose controls such as water. The most relevant comparisons are the parallel design studies which compare the effects of aspartame with sucrose. These had an overall effect size of 0.4SD. This corresponds to a mean reduction of about 10% of energy intake. At an average energy intake of 9.3MJ/d (average of adult men and women aged 19 to 50 years) this is a deficit of 0.93MJ/d (222kcal/d or 1560 kcal/week), which would be predicted (using an energy value for obese tissue of 7500kcal/kg) to result in a weight loss of around **0.2 kg/week** with a confidence interval 50% either side of this estimate.

Compensation: Information on the extent of compensation was available for 12 of the 15 studies. The weighted average of these figures was 32%. Compensation is likely to vary with a number of factors such as the size of the caloric deficit, the type of food or drink manipulated, and timescale. An estimate of the amount of compensation with soft drinks was calculated from the four studies which used soft drinks only as the vehicle. A weighted average of these figures was 15.5%.

Weight loss: A significant reduction in weight was seen. The combined effect figure of 0.2SD is a conservative figure as it excludes comparisons where the controls gained weight due to their high sucrose diet and the long-term follow-up data in which the aspartame groups re-gained less weight than the control group. An effect of 0.2SD corresponds to about a 3% reduction in body weight (2.3kg for an adult weighing 75kg). Given the weighted average study length was 12 weeks, this gives an estimated rate of weight loss of around **0.2kg per week** for a 75kg adult.

Conclusions from our systematic review and meta-analysis: We demonstrated that using foods and drinks sweetened with aspartame instead of sucrose results in a significant reduction in both energy intakes and body weight. Both the meta-analyses of energy intake and of weight loss produced an estimated rate of weight loss of about 0.2kg/week. This close agreement between the figure calculated from reductions in energy intake and actual measures of weight loss gives confidence that this is a true effect.

Practical implications: This review has shown that using foods and drinks sweetened with aspartame instead of those sweetened with sucrose is an effective way to maintain and lose weight without reducing the palatability of the diet. Some compensation for the substituted energy does occur but this is only about one third of the energy replaced and is probably less when using soft drinks sweetened with aspartame. Nevertheless, these compensation values are derived from short term studies. More data are needed over the longer term to determine whether a tolerance to the effects is acquired.

To achieve the average rate of weight loss seen in these studies of 0.2kg/week will require around a 220kcal deficit per day based on an energy value for obese tissue of 7500kcal/kg. Using the lower estimated rate of compensation for soft drinks alone (15.5%) would require the substitution of about 260kcals/day from sucrose with aspartame. This is equivalent to 70g sucrose or about 2 cans of soft drink every day.

Confirmation of our conclusions from other authors: In spite of publication of this review, there have still been many internet rumours (usually based on animal studies), that the use of low calorie sweeteners can be fattening. A critical review explored all purported mechanisms and concluded most are not supported by any evidence. Further risk benefit assessment comparing two extreme scenarios whereby all carbonated soft drinks (consumed by young adults in Netherlands) were sweetened with sugar or low calorie sweeteners showed that there would be beneficial effects on BMI in the latter scenario.

Can low calorie sweeteners help you to lose weight? If used correctly, all the evidence says YES.

Dr Tommy LS Visscher

The health benefits of losing a small amount of weight

Obesity has an important public health impact, as obesity has a strong association with chronic diseases and impairments, such as diseases as type 2 diabetes mellitus, coronary heart disease, and work disability. Thus, interventions aiming at weight control can be regarded as successful when having an impact on chronic diseases.

Environmental interventions are now deemed utmost important in the prevention of obesity. Integrated approaches such as applied in the EPODE-methodologies indeed show large successes in the reduction of obesity. Despite these large and important effects of integrated approaches, questions are still being focussed on the impact of single aspects in such multi-disciplinary approaches. One such an aspect could well be replacing sugars by sweeteners.

Although individual interventions contribute to only a small part of weight control, it is irrational to believe that such interventions are therefore not adding to the big impact on prevention of chronic diseases. Hence, it is shown in the literature that even small reductions in body weight are having major impact on reduced incidence of chronic disease.