

**Plenary Session RTD 1**  
**Non-Nutritive Sweeteners and Energy Balance: Use, Misuse and Mechanisms**

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**Abstract**

Non-nutritive sweeteners (NNS) were introduced into the food supply for multiple purposes. They offer the food industry novel opportunities for product development and profit and consumers the option to enjoy palatable items with lower carbohydrate and/or energy content. Data on the levels and patterns of use are lacking due to the absence of regulations requiring reporting of concentrations present in foods. However, a recent estimate of use in the United States indicates they are consumed by approximately 10.8% and 5.8% of the population in beverages and solid foods, respectively. They contribute the sweetening equivalent to the diet of about 53g of sucrose daily in the general population. The safety of approved sweeteners has been extensively studied and verified, but evidence that their most commonly cited function, as a means to dilute the energy density of the diet by substitution for nutritive sweeteners (NS) to manage body weight, is less than compelling. Early studies indicated that the addition of NNS to a non-energy yielding product could stimulate hunger. However, subsequent work revealed that this was not routinely observed when NNS were added to energy-yielding products and it is doubtful that ingestion of a product containing a NNS and not supplying energy will stimulate hunger when combined with foods that do yield energy. Epidemiological trials often report an inverse association between NNS use and BMI that in many, although not all, cases may be best explained by reverse causality (i.e., heavier individuals use products with NNS as a means to moderate intake). Multiple clinical trials indicate covert substitution of NNS for NS leads to incomplete dietary compensation, resulting in a 10-15% reduction in daily energy intake. However, knowledge of their use may lead to stronger compensation, and possibly, even reverse compensation (i.e., greater energy intake). The longest-term clinical intervention trial with NNS failed to document greater weight reduction with their use. While true substitution of NNS for NS in foods and beverages without alteration of other aspects of the diet would theoretically moderate energy intake and body weight gain or facilitate weight maintenance, rarely is this the case. Typically products containing NNS only partially replace other items or are actually added to the diet, especially as beverages, leading to increased energy intake. Numerous mechanisms have been proposed to account for the increased and decreased dietary responses to NNS ingestion. Most lack solid scientific evidence. Several that indicate NNS may be problematic for weight management (e.g., relaxed cognitive control of feeding, signaling dysregulation) warrant further study. Resolution of the role of NNS in weight management will require well-executed randomized controlled clinical trials.