

# Policy Statement

## The Use of Artificial Sweeteners

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### Definitions

Foods and beverages may be sweetened with sugars or artificial sweeteners:

- Sugars (also called caloric sweeteners, nutritive sweeteners) provide calories (i.e., energy in the form of carbohydrates) such as fructose and sucrose (e.g., table sugar, honey, syrup; 3.75kcal-gram).
- Artificial sweeteners (also called sugar substitutes, high-intensity sweeteners, high-potency sweeteners, non-nutritive sweeteners) provide little or no calories.

NB: Polyols (e.g., sorbitol, mannitol, xylitol) are sugar alcohols and are classed under the 'Sugars' category. However, they contain less sugar and calories than 'Sugars'. Polyols contain 2.4kcal-gram.

### Summary

Artificial sweeteners provide sweetness and little or no calories, unlike sugars that do provide calories. The European Food Safety Authority (EFSA) re-evaluate the use of all artificial sweeteners. This is an on-going process. For example, the next re-evaluation of artificial sweeteners that were approved for use in the EU prior to 2009 is due for completion by 2020 [1]. The evidence-base shows that artificial sweeteners are considered safe to consume up to the Acceptable Daily Intake (ADI) in the general population with the exception of foods for infants and young children. Adding an artificial sweetener to a food product instead of sugar enables food manufacturers to provide an alternative for consumers which can be a useful strategy for those individuals seeking to control their calorie intake and manage their weight.

### The BDA believes that:

1. Artificial sweeteners available to purchase in the UK are considered safe to consume up to the ADI in the general population with the exception of foods for infants and young children, and are authorised and approved for use by EFSA.
2. Opting for an artificial sweeteners may assist in the management of weight and in the management of other health conditions such as diabetes mellitus in some individuals. A tailored individualised approach is required.
3. From a dietetic perspective, artificial sweeteners may be included as part of a dietetic intervention, though recommendation should be given on a case-by-case basis.

## Background

There are eleven types of artificial sweeteners with different sweetness potencies licensed for use in the UK.

Artificial Sweetener	EFSA Scientific Opinion	Commission Regulation (EU) Specifications <sup>[2]</sup>
Acesulfame-K		Approximately 200 times as sweet as sucrose
Advantame	Approximately 37,000 times sweeter than sucrose <sup>[5]</sup>	
Aspartame		Approximately 200 times as sweet as sucrose
Cyclamate		Approximately 30-40 times as sweet as sucrose
Neohesperidine Dihydrochalcone		Approximately between 1,000 and 1,800 times as sweet as sucrose
Neotame	Approximately 7,000 to 13,000 times greater than that of sucrose <sup>[4]</sup>	
Saccharin		Approximately between 300 and 500 times as sweet as sucrose
Steviol Glycosides		Approximately between 200 and 300 times sweeter than sucrose
Sucralose	A sweetness potency around 600-650 times that of sucrose <sup>[3]</sup>	
Thaumatococin		Approximately 2,000 to 3,000 times as sweet as sucrose
Aspartame-acesulfame salt	No information currently available	

[2] Commission Regulation (EU) (2012)

[3] Opinion of the Scientific Committee on Food on sucralose (2000)

[4] EFSA Scientific Opinion on Neotame (2007)

[5] EFSA Opinion on Advantame (2013)

As a result of growing health awareness and an increase in obesity-related health conditions in the UK, there has subsequently been an increased demand of food products that support good health. More specifically, the food manufacturing industry commonly replace sugar with an artificial sweetener replacement. Results from the latest National Diet and Nutrition Survey (NDNS) indicate that 44% of adults 19-64 years consume low-calorie beverages [6]. It is widely accepted that a high sugar/high fat diet is in part, responsible for increased weight gain and associated health conditions such as type 2 diabetes mellitus (T2DM), cardiovascular disease (e.g., coronary heart disease) and certain cancers. Notably, a relatively small weight reduction (5%) is associated with improved health outcomes [7]. In the UK population, current average intakes of free sugars (previously used term is non-milk extrinsic sugars; NMES) are at least twice the new 5% recommendation [8]. Whilst a reduction in sugar consumption is an encouraging strategy for supporting optimal nutrition and in the management of an individual's weight, the causes of obesity are multi-factorial, consisting of a complex interplay of environmental, psychological and social factors.

## Functions and Benefits

### Energy Intake and Weight Management

Artificial sweeteners are classed as food additives which replicate the sweetness of sugar but without the addition of extra calories. For example, a recent systematic review and meta-analysis concluded that calorific sugar-sweetened beverages promoted weight gain in children and adults [9,10]. For this reason, use of artificial sweeteners may in part, assist in the reduction of total energy intake and facilitate weight loss or weight maintenance, if used in place of energy-dense options. A recent meta-analysis investigating low-calorie sweeteners on body weight and composition found that substituting low-calorie sweetener options for their regular, more energy-dense versions resulted in a modest weight loss [11]. Furthermore, a systematic review and meta-analysis published in 2016 concluded that low-calorie sweeteners in place of sugar may be helpful in reducing energy intake and body weight in children and adults [12]. However, results were inconsistent and showed wide variation between studies. Notably, good quality long-term trials are required before definitive conclusions can be made.

Furthermore, it has been suggested that artificial sweeteners can interfere with normal homeostatic, physiological processes (e.g., altering taste and metabolic signaling) [13]. Equally, a recent review showed no consistent association with a heightened appetite for sugar or sweet products [14]. Indeed, it is possible that because blood glucose levels do not significantly alter with use of artificial sweeteners, there may be an increased risk of hypoglycemia which may lead to a subsequent increase in food intake (i.e., as a compensatory mechanism) [15]. However, a review of RCTs does not support this hypothesis [16].

### Dental Health

Artificial sweeteners may play a role in dental health (i.e., prevention of dental caries) as they are non-cariogenic. In other words, they are not fermented by the oral microflora, unlike sugar and do not cause tooth decay. A recent systematic review and meta-analysis could not conclude whether or not xylitol-containing products can prevent tooth decay in infants, older children, or adults due to the low to very low quality evidence which was based on the small amount of available studies, uncertain results, and issues with the way studies were conducted [17]. Equally, EFSA suggested that artificial sweeteners may help maintain tooth mineralisation by decreasing the rate of tooth demineralisation [18].

### Diabetes

Regulating blood glucose levels in those individuals with diabetes is important to prevent risk of diabetes-related health complications. Since artificial sweeteners are not processed by the body in the same way as sugar, replacing sugar with an artificial sweetener may help stabilise blood glucose levels over a longer period. This may also have particular relevance in those with reactive hypoglycaemia whereby excess insulin is produced after a large carbohydrate-based meal [19]. As artificial sweeteners do not affect the insulin response in the same way, it is plausible that artificial sweeteners may reduce the risk of reactive hypoglycaemia. EFSA also approved the health claim that artificial sweeteners may help in the reduction of post-prandial glycaemic responses [18]. Additionally, the use of artificial sweeteners in those with T2DM may also help with weight loss or weight maintenance, thus facilitating good diabetes control. Current evidence-based recommendations for people with diabetes suggest artificial sweeteners are safe when consumed within the ADI [20].

## Health and Safety

EFSA provides scientific analysis, opinion and recommendations to support policy development on food safety issues in the European Union (EU) [21]. All artificial sweeteners used in the EU have undergone safety evaluation (e.g., toxicological testing) before being approved for use. The Joint Food and Agriculture Organisation (FAO)/World Health Organisation (WHO) Expert Committee on Food Additives (JECFA) and UK Government regulate and authorise the use of artificial sweeteners, providing food manufacturers with stringent guidelines on the maximum quantity of artificial sweetener that can be added to foods and drinks [22]. As part of the safety and approval process, EFSA sets an ADI for each artificial sweetener. The ADI is an estimate of the amount of artificial sweetener (milligrams per kilogram of body weight) that can be safely consumed on a daily basis over a person's lifetime without incurring health risks. From a safety perspective, the ADI includes a 100-fold safety factor. In other words, the ADI is calculated at one hundredth of the amount that may be safely consumed. Artificial sweeteners are considered safe for consumption during pregnancy. However, foods and drinks containing artificial sweeteners should not replace more nutritious options (e.g., the consumption of 'diet' drinks in replacement of milk-based drinks or fruit juice).

To put into context, the current ADI for Aspartame is 40-mg·kg·body weight·day [23]. This is the equivalent to 2800mg for a 70kg adult. An average can of Diet Coke contains 180mg of Aspartame. Therefore, an adult would have to consume 15 cans (or 5.1 litres) of Diet Coke on a daily basis over a lifetime before reaching the ADI.

## Phenylketonuria (PKU)

In the UK, it is a legal requirement if a food product contains Aspartame. It must be clearly stated on the label 'contains a source of phenylalanine'. Labelling is of particular importance for consumers with PKU; a rare genetic disorder in which the amino acid phenylalanine cannot be metabolized due to the deficiency of the enzyme phenylalanine hydroxylase. Phenylalanine can accumulate to harmful levels if not controlled with diet.

## Sweeteners Permitted For Use in Foods

Artificial sweeteners are permitted for use in a wide variety of foods and beverages in the UK including carbonated drinks, fruit juices, jellies, yogurts, desserts and ice cream, chewing gum and sweets and foods and drinks labelled as 'sugar-free' or 'diet'.

NB: Some foods and beverages may be naturally sugar-free (e.g., bottled water).

## Sweeteners Not Permitted For Use in Foods

In line with EU regulation, artificial sweeteners are not permitted in some foods in the UK. For example, the use of sweeteners is prohibited in all foods for infants (under 12 months old) and young children (1-3 years old). This includes foods specifically prepared for infants and young children (i.e., 'baby food') [24]. One of the reasons for this is due to the specific nutritional needs and increased energy requirements infants and young children have for optimal developmental growth.

## Consumer/Patient Viewpoint

There remains strong evidence that artificial sweeteners are considered safe to consume as per EFSA recommendations. However, from a consumer perspective, the safety of artificial sweeteners can be confused by mixed messages in the media. For example, there continues to be on-going controversy regarding the use of artificial sweeteners and whether they pose a risk to health such as whether they play a role in the pathogenesis of cancer, lymphoma, leukaemia, chronic fatigue syndrome, Parkinson's disease, Alzheimer's disease, multiple sclerosis, autism and lupus [25]. To date, there is substantial evidence to suggest artificial sweeteners do not play a role in the development of these health conditions.

## Correlations to Diet Quality

Currently, the limited research exploring diet quality and the use of sugars or artificial sweeteners suggest that overall diet quality is lower in those individuals who consume sugar-sweetened or artificially sweetened beverages compared to non or low consumers [26], whilst the National Diet and Nutrition Survey (NDNS) found that non-consumers and low-calorie beverage consumers tend to have higher quality diets compared with sugar-sweetened beverage or both beverage consumers [6]. However, given the nature of these studies, a cause-effect relationship cannot be implied. In other words, consuming artificially sweetened beverages does not necessarily translate to a higher quality diet.

## Concerns from BDA Perspective

In accordance with EU labelling regulations, food products that contain artificial sweeteners must be labelled twice (either the name of the sweetener or the E-number). In addition, the term 'with sweetener(s)' must also be stated. However from a consumer perspective, whilst the term 'with sweetener(s)' may be recognised, the name of the artificial sweetener (e.g., saccharin) or the E-number (e.g., E954) may be less recognised, and therefore may not be 100% clear to the consumer as to whether a particular product contains an artificial sweetener. Additionally, the BDA is concerned that consumers may find food labelling confusing, coupled with the fact that product labels often contain a large volume of information, there is the danger that consumers may feel overwhelmed. For this reason, a future approach for consideration may be to include the quantity of sweetener contained in the food or beverage product on the label, alongside the ADI for comparative purposes. This would be particularly relevant for those individuals who consume large quantities of sweetener-containing foods and beverages.

## Research Gaps and Future Research

Current obesity-related governmental policies do not currently address sugars, artificial sweeteners and the impact on weight. Further research is also required investigating the hormonal and metabolic responses to artificial sweeteners including the influence on taste responsiveness and preferences. EFSA has previously examined the effects of artificial sweeteners on preterm delivery and concluded artificial sweeteners are safe [27].

Another topic for future discussion is whether artificial sweeteners should be encouraged by Dietitians in place of regular sugar options to assist in the control of calorie consumption. Given that intake of artificial sweeteners is mostly from beverages, emphasis should be placed upon encouraging behaviour change with focus on overall diet quality and eating patterns, rather than specific nutrients.

## Conclusions

From a dietetic point of view, having options which allow patients and (or) clients to alter their calorie intake without making significant dietary changes is seen as a favourably viable option. However, a whole diet approach which focuses on overall diet quality rather than specific ingredients and nutrients is important. The recent Scientific Advisory Committee on Nutrition (SACN) report [8] highlighted that there is some evidence showing that sugar-sweetened beverages are linked to weight gain and consistent evidence showing an association with an increased risk of T2DM. Swapping sugar-sweetened beverages for artificially sweetened beverages is likely to be beneficial for most individuals from a weight management, dental and diabetes perspective; however, healthier drink options/alternatives should be actively encouraged (e.g., milk-based drinks) as these provide additional nutritional benefits that artificially sweetened beverages do not. Overall, the strength of the evidence for sweetener use and the translation in improvements in health-related outcomes depends on the topic specified. For example, the evidence surrounding sweeteners and dental health is stronger than the evidence for use in diabetes and weight management. Equally, artificial sweeteners are considered safe and for that reason, the BDA recommends that they may be included as part of a dietetic intervention, though recommendation should be given on a case-by-case basis.

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