# Discovering Stevia

## What health professionals need to know

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In an attempt to address the nation's poor eating habits, attention has recently been given to the use of low calorie sweeteners (LCS) in foods and drinks. One such sweetener, stevia, is relatively new to the market and so to learn more about it, and discover how it could be relevant to our clinical practice, I recently attended an event hosted by the Global Stevia Institute – an organisation that provides science-based information on stevia, and Thirst for Knowledge – an educational initiative from Coca-Cola Great Britain (CCGB) that's designed to better support the needs of healthcare professionals and patients.

### What is stevia?

Dr Margaret Ashwell, Independent Scientific Consultant and Advisory Board Member of the Global Stevia Institute (GSI), and representatives of Pure Circle, a leading producer and marketer of high purity stevia ingredients, provided thorough insights into the science behind stevia.

Stevia is a plant native to Paraguay but is now grown across five continents for its sweet leaves. Steviol glycosides, compounds in the leaves responsible for their sweetness, are up to 350 times sweeter than sugar.[1] There are eleven main steviol glycosides, the most abundant ones being Rebaudioside A and Stevioside. Chemically all the steviol glycosides share a common diterpene steviol backbone, but the arrangement and number of glucose units on this backbone vary (R1 and R2 in **Figure 1**). This provides each steviol glycoside with their unique taste and sweetness profile.

To produce the sweetener used in commercial products, steviol glycosides are extracted from the leaf by steeping the leaves in warm water (similar to brewing tea leaves in water) before being purified to produce a high purity extract that contains 95 per cent or more steviol glycosides. These steviol glycosides retain the same chemical form as found in the original leaf. While the term stevia is the generic term given to the plant, leaves and extract, it's only this high purity extract that's approved by major regulatory bodies around the world for use in foods and drinks.

Evidence from more than 200 studies have supported the safety of stevia for both the general population, as well as special groups such as pregnant and lactating women, children, allergy sufferers and people with diabetes.

Steviol glycosides were approved for use in Europe in 2011[2] and an Acceptable Daily Intake (ADI) – the amount that can be safely consumed every day, over the course of a lifetime – has been set at 4 mg/ kg body weight/ day. To put this into context, a 70 kg person would have to consume about 40 packets of table top stevia sweetener every day, throughout their life, to reach the ADI. Furthermore the ADI is well below the predicted estimated intake among different population groups (**Table One**).[3]

Figure 1: Chemical Structure of a Steviol Glycoside

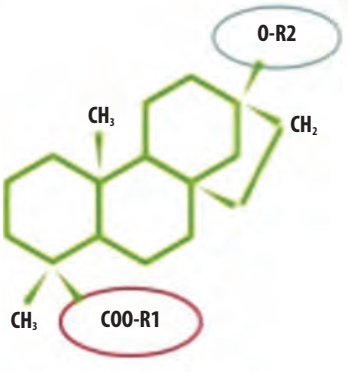


Table One: Estimated Daily Intake of Steviol Glycosides

| | |
|---|---|
| Average intake of the general population and children | 0.4 to 0.7 mg/kg body weight/day |
| Highest intake among adult and children | 1.1 to 1.7 mg/kg body weight/day |
| Highest intake among diabetic children | 1.5 mg/kg body weight/day |

## Metabolism of stevia

Steviol glycosides pass through the upper gastrointestinal tract undigested. In the colon the glycoside groups are removed by gut bacteria. Although the glucose groups get fermented here, and fermentation has a calorie value of 2 kcals/gram, insignificant amounts of calories are produced due to the tiny quantities of sweetener used. The steviol backbone is absorbed and taken to the liver where it's metabolised to steviol glucoronides which are then excreted in the urine.[4] Studies have found no accumulation of stevia, or any by-product of stevia, in the body following consumption.[2,5]

## Why use stevia?

At a time when the nation's sugar intake is higher than recommended and overweight and obesity are major public health issues, replacing some of the sugar in the diet with a LCS may help reduce daily energy intake and so help with weight management. Mr Olivier Kutz, Marketing Manager at PureCircle, explained how stevia now increases the range of LCS available and offers a new, zero-calorie, naturally-sourced alternative which is particularly important to consumers.

The regulatory framework[2] provides guidelines on the use of steviol glycosides in different food and drink categories, including maximum levels of sweetener permitted and certain exceptions. For example, in some categories they can only be used in energy reduced products where there will be an energy reduction of at least 30 per cent. Due to these regulatory constraints, in some cases steviol glycosides can't replace all the sweetness typically provided by sugar. For this reason steviol glycosides may be used in combination with other types of sweeteners, including sugar, to achieve the desired level of sweetness.

## Where is stevia used?

Steviol glycosides are sold both as a sole sweetener and as a blended sweetener (sometimes with sugar or other non-caloric sweeteners). They can be found in 'tablet' and liquid forms, as well as table top sweeteners, and recently they've been used to reduce the sugar in mainstream foods and drinks, e.g. in non-fermented dairy products, sauces, jams, desserts, soft drinks and juice drinks. Anna Wheeler, Health and Nutrition Manager at Coca-Cola Great Britain, highlighted this using the example of the recently launched Coca-Cola Life – CCGB's first lower-calorie cola – which is sweetened with a blend of sugar and naturally-sourced stevia leaf extract. Coca-Cola Life contains a third less sugar and a third fewer calories than regular cola.[6]

It's anticipated that using stevia in this way will enable more reduced sugar, mainstream products to become available, providing consumers with a greater choice of mid-calorie options.

## Stevia's role in weight management

One short-term study found stevia had no effect on satiety.[7] However, Dr Ashwell explained currently there's no long term trials examining the effectiveness of stevia in weight control. Despite this she believes there's no reason why the results would be any different from studies using other LCS.

A recent meta-analysis of these LCS studies – which included results from nine prospective studies with more than 100,000 subjects and 15 randomised controlled studies including 1951 subjects – found that replacing caloric sweeteners with LCS results in a loss of Body Mass Index, fat mass and waist circumference.[8] These results are reassuring as LCS have previously been criticised for actually increasing our desire for sweet foods, stimulating hunger which results in overeating, and not promoting satiety. While these mechanisms have now been rejected,[9] in some studies comparing LCS to caloric sweeteners the energy reduction and/or weight loss is not as great as expected. This suggests there is still some degree of compensation which maybe mainly psychological rather than physiological.

The need to reduce overall sweetness among the population, rather than rely on sweeteners, was a topic raised at the event. However, it was explained that reducing the preference for sweetness may not be as easy to achieve as it has been for salt. Sweetness is generally regarded as a driver for taste and if there's difficulty in reducing this innate liking, one particular challenge in weight control is being able to sustain long-term dietary changes. The use of stevia to produce lower sugar, lower calorie mainstream products people enjoy, could help with this long-term adherence.

**Practical considerations for weight management:**

- Stevia is a naturally sourced, calorie free sweetener and increases the range of LCS now available
- Swapping higher calorie containing foods and drinks for products sweetened with stevia can help reduce calorie intake, but only as part of an overall balanced, energy reduced diet. For examples see **Table Two**
- Stevia sweetened products shouldn't be seen as a green light to eat more than would otherwise be eaten – while being lower in calories, they may still not be low calorie
- Stevia is heat stable and can be used for baking – manufacturers' instructions on how to substitute stevia for sugar should be followed as different brands will require different adjustments.

### Table Two: Swap Examples

| Instead of | Choose | Calorie Saving |
|---|---|---|
| 1 tsp sugar in hot drink | 1 stevia sweetener tablet* | 20 kcals |
| 1 tsp sugar on cereals, desserts, etc. | 1 tsp of stevia granulated sweetener* | 20 kcals |
| 1 tsp sugar in baking | 1 tsp of sugar and stevia blend* | 12 kcals |
| Can of standard Coca-Cola | Can of Coca Cola Life | 50 kcals |

* Different brands may vary in calorie content

References: **1.** Prakash I, Markosyan A, Bunders C (2014). Development of next generation stevia sweetener: Rebaudioside M. Foods.; 3: 162-175. **2.** European Commission Regulation (EU) No 1131/2011 of 11 November 2011 amending Annex II to Regulation (EC) No 1333/2008 of the European Parliament and of the Council with regard to steviol glycosides. Official Journal of the European Union. December 11, 2011. Accessed online: http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:295:0205:0211:EN:PDF (November 2014). **3.** Renwick AG (2008). The use of a sweetener substitution method to predict dietary exposures for the intense sweetener rebaudioside A. Food Chem Toxicol.; 46(7): S61-9. **4.** GardanaC, et al (2003). Metabolism of Stevioside and Rebaudioside A from Stevia Rebaudiana extracts by Human Microflora. J. Ag. Food Chem.; 51(2): 6618-6622. **5.** European Food Safety Authority, Panel on Food Additives and Nutrient Sources added to Food. Scientific opinion on the safety of steviol glycosides for the proposed uses as a food additive. EFSA Journal. 8(4):1537. 2010. [3. Biological and toxicological data (pg 20); 3.1. Absorption, distribution, metabolism and excretion (pg 20); 3.1.1. In vitro studies (pg 20); 3.1.2. In vivo studies (pg 20)]. www.efsa.europa.eu/en/efsajournal/pub/1537.htm **6.** 36% less calories vs full sugared colas in GB, due to a sugar reduction of 37% thanks to stevia leaf extract. **7.** Anton SD, et al (2010). Effects of stevia, aspartame, and sucrose on food intake, satiety, and postprandial glucose and insulin levels. Appetite; 55(1): 37-43. **8.** Miller PE, Perez V (2014). Low-calorie sweeteners and body weight and composition: a meta-analysis of randomized controlled trials and prospective cohort studies. The American Journal of Clinical Nutrition; 100(3): 765-777. **9.** Mattes RD, Popkin BM (2009). Nonnutritive sweetener consumption in humans: effects on appetite and food intake and their putative mechanisms. The American Journal of Clinical Nutrition; 89(1): 1-14.

THIRST FOR KNOWLEDGE

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