Association des Amidonniers et Féculiers
European Starch Industry Association

FACTSHEET ON GLUCOSE FRUCTOSE SYRUPS AND ISOGLUCOSE

1. Understanding the terms

Terms like glucose fructose syrups, isoglucose and High Fructose Corn Syrups (HFCS) are often confused and used interchangeably. This section aims to clarify the differences.

Glucose is a simple sugar found naturally in many foods. Long chains of glucose molecules linked together form starch.

Fructose is also a simple sugar found in many foods. It is the sweetest of all naturally occurring sugars. High levels of fructose are, for example, typically found in honey, in fruits notably tree fruits (oranges, apples, etc.), berries, melons and in some root vegetables such as sweet potatoes, parsnips and onions.

Sucrose, or table sugar, **is made up of glucose and fructose** linked together in a 1:1 ratio.

Glucose-Fructose syrup is a liquid sweetener used in the manufacturing of foods and beverages. It is composed of different sugars, mainly glucose and fructose, with varying compositions, with a fructose content ranging from 5 to 50%. If the fructose content exceeds 50%, the product becomes a **Fructose-Glucose syrup**.

The Glucose-Fructose syrups[1] and Fructose-Glucose syrups are made typically from wheat or maize starch, by first making a glucose syrup, then through a process called 'hydrolisation', liberating free glucose molecules. With the use of enzymes, some of these glucose molecules are then changed into fructose in a process called 'isomerisation'.

In Europe, because of this 'isomerisation' process, Glucose-Fructose syrups and Fructose-Glucose syrups with a fructose content of more than 10% are referred to as **isoglucose**[2].

In the United States, this type of product is produced from maize starch, most commonly either with a 42% or a 55% fructose content and is called **High Fructose Corn Syrup (HFCS).**

[1] For a legal definition of glucose fructose syrup please see Council Directive 2001/111/EC, of 20 December 2001, relating to certain sugars intended for human consumption, OJ L10, 12 January 2002, p. 53

[2] For a definition of isoglucose please see COUNCIL REGULATION (EC) No 1234/2007 of 22 October 2007 establishing a common organisation of agricultural markets and on specific provisions for certain agricultural products (Single CMO Regulation) – definition on page 89

2. The uses of Glucose Fructose Syrups (GFS)

Glucose fructose syrups are found in many food and drinks, not only for their sweetening characteristics, but also for their other specific properties, for example to prevent crystallisation in confectionery and to prevent sweets from sticking to their wrappers. The extent of GFS use and the type of GFS used can also be impacted by differences in regulatory approach (e.g between the US and the EU)

GFS is mainly found in confectionery, beverages, jams and preserves, baked goods, cereal products , yogurts and other dairy products, condiments and canned and packed goods. Its use in soft drinks in the EU has been limited because soft drinks need a fructose content of at least 42% to achieve their desired level of sweetness and GFS with such a high level of fructose is not available in the EU in sufficient quantities This is because in the EU, the production of isoglucose (glucose fructose syrups with more than 10% of fructose) is limited by the EU sugar regime to 5% of total EU sugar production. Its use is therefore more limited than elsewhere in the world. In the EU soft drinks are therefore sweetened primarily using sucrose, which has a fructose content of 50%.

In the US, no production limits exist on GFS, and HFCS today constitutes up to 50% of US sugar consumption. Its main application is in soft drinks[i].

3. The nutritional properties of GFS

GFS, other starches and sucrose contain the same number of calories. Sucrose and HFCS contain very similar levels of fructose and glucose and have the same nutritional impact. Studies comparing beverages with different levels of fructose have not demonstrated any differential effects on feelings of fullness between fructose and other sugars[ii]. Obesity is primarily the result of an imbalance between calories consumed (from whatever source, sucrose, HFCS or other) and calories burned through physical activity

Human beings derive their energy from carbohydrates, proteins and fats. EFSA (European Food Safety Authority) published guidelines suggesting that carbohydrates should constitute 45-60% of total energy intake for both adults and children[iii].

GFS is a sugar and one source of carbohydrates. Other carbohydrate sources include other starchy foods like bread, potatoes and pasta and also, sucrose, bread and other food products that are commonly found in the diet.

GFS, other starches, and sucrose all contain the same number of calories, 4 kcal/g[iv].

As a result of the prevalence of GFS in the US, at levels with a similar fructose level to sucrose (i.e. HFCS), there has been extensive research in that country comparing the health and nutritional characteristics of HFCS with sucrose.

Evidence demonstrates that fructose and glucose, the main constituents of both HFCS and sucrose are metabolised in different ways in the body [v].

However, studies comparing beverages with different levels of fructose have not demonstrated any differential effects on feelings of fullness between fructose and other sugars[vi]. More generally, when fructose or fructose-containing sweeteners are used as an alternative to other carbohydrates in diets providing similar calories, no adverse effect on body weight is observed[vii]. To cite *Sievenpiper J L,* 'Fructose, if consumed in high doses can contribute to increasing bodyweight but such effect would be due to excessive caloric intake rather than to the consumption of fructose itself'[viii].

What the evidence also clearly demonstrates is that sucrose and HFCS which both contain very similar levels of fructose and glucose, will be absorbed and metabolised in the same way, and as such their impact on nutrition/obesity is the same[ix].

The American Medical Association clearly stated in June 2008 that 'high fructose syrup does not appear to contribute to obesity more than other caloric sweeteners'[x], a view supported by the American Dietetic Association who noted that 'High Fructose Corn Syrup is nutritionally equivalent to sucrose. Both sweeteners contain the same number of calories (4 per gram) and consist of about equal parts of fructose and glucose. Once absorbed into the blood stream, the two sweeteners are indistinguishable'[xi].

The increasing rates of obesity, both in the US and Europe, and indeed elsewhere in the world, are as nutritionists, health experts and researchers generally agree, primarily the result of an imbalance between calories consumed and calories burned, whatever the source of the calories may be. The solution to reducing obesity is promoting a balanced diet and sufficient physical activity[xii].

Issued in June 2013

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