Sweeteners

Sugar is sweet, but so are many other substances. Are these better alternatives to traditional sugar?

A little something sweet is often a nice treat. But sugar can provide 'empty calories', or energy for the body without other nutrients. This makes it important not to rely on sugar too much as a source of energy and to make preference for nutrient-rich foods.

But some of us want to satisfy our sweet tooth. If we want to avoid the calorific intake that accompanies sugar there are low-calorie sweeteners on the market. But could these products have a negative impact on our health? Sugar is a natural product, so is it better? How do other sugar alternatives compare in the sweet debate?

Classification of sugars

Sugars are a type of carbohydrate. The sugar we add to our food and drinks is just one type of sugar. Sugar can also occur naturally in foods, such as fructose in fruit, and lactose in milk. Sugars can be classified as follows:

- Monosaccharide - single sugars e.g. fructose, glucose and galactose
- Disaccharide - double sugars e.g. sucrose (fructose and glucose), lactose (glucose and galactose)
- Polyols - sorbitol, mannitol, xylitol. These are sugar alcohols; they are not sugar or alcohol but resemble both sugar and alcohol in chemical structure. They are generally less sweet than sugar, with fewer calories.

Artificial and low calorie sweeteners have a sweet taste, but are not sugars.

Metabolism of sweeteners

In digestion, sugar is broken down into its simplest form. Disaccharides or double sugars are broken down into monosaccharides or single sugars. Insulin made in the pancreas regulates the flow of glucose in the blood. When blood sugar levels are not regulated properly, diabetes can occur. There are two types of diabetes: Type 1 where the pancreas produces little or no insulin, and Type 2 where the body can no longer regulate blood sugar effectively, as the ability to produce and use insulin is reduced. Diet is linked with the development of Type 2 diabetes. Over-consumption of sugars can put extra pressure on the pancreas to produce insulin, which the pancreas sometimes cannot maintain. The type of sugar is also important here as Type 2 diabetes is specifically linked with over-consumption of refined sugars, which enter the bloodstream quickly. Less refined, more complex sugars have to be broken down to simple sugars in the body so enter the bloodstream at a slower rate. The type of sugar we consume affects how our body can deal with it.

Not all sugars are metabolised in the body in the same way. Fructose is mainly metabolised in the liver and does not require insulin for its use in the body. Other sweeteners besides sugar often don't require insulin to regulate them as they are not metabolised by the body. Artificial sweeteners such as saccharin are excreted by the body and don't contribute to blood glucose levels. Some are partially metabolised by the body, like polyols. These substances have a use in our diets in providing the sweet taste that sugar usually

AT A **GLANCE**

Diabetes.

Low-calorie sweeteners.

Natural sweeteners.

choice comment

Sweeteners, whether natural or artificial, should not be consumed in excess. Sweeteners are often not a good source of micro-nutrients, like vitamins and minerals. But apart from the direct nutritional perspective on sweeteners, in weighing up the value of sugar in our diets we must also consider how sugars are used in the body and how this affects our health. Sugars that occur naturally in foods will enter the bloodstream more slowly than the sugar we add to foods. We must also be aware of hidden sugars. When considering the merits of any food, the central point often returns to the simple advice, everything in moderation.

Useful contacts

Food Safety Authority of Ireland
Abbey Court
Lower Abbey Street
Dublin 1
1890 336 677
tel (01) 817 1300
fax (01) 817 1301
email info@fsai.ie
www.fsai.ie

Irish Nutrition and Dietetic Association
Ashgrove House
Kill Avenue
Dun Laoghaire
Co. Dublin
email info@indi.ie
www.indi.ie

Diabetes Federation of Ireland
79 Lower Gardiner Street
Dublin 2
1850 909 909
tel (01) 836 3022
fax (01) 836 5182
email info@diabetes.ie
www.diabetesireland.ie

provides, but without affecting blood sugar levels or providing energy.

Low calorie sweeteners

The EU directive 94/35/EC governs the use of sweeteners in foodstuffs. Permitted artificial sweeteners are given an E number (see Table 1). This directive also covers foods that sweeteners can be added to and the maximum permitted levels. Directive 95/31/EC sets down criteria for the purity of sweeteners that are used in foods.

There are many sweeteners used in foods. They can be artificial, but some also come from natural sources. Xylitol is derived from plants such as the birch tree.

Sweeteners commonly used as tabletop sugar substitutes include aspartame, saccharin and sucralose. Some will provide no calories (e.g. sucralose, saccharin), while others are very low calorie (e.g. aspartame). These are often suitable for diabetics, and are especially useful for insulin-dependent diabetics in providing some sweetness in the diet without the use of sugar. They can also replace sugar in cooking, providing they are heat stable. Saccharin and sucralose are both heat stable. They can also be referred to as intense sweeteners, as they are often much sweeter than sugar. For example, sucralose is 500-600 times sweeter and aspartame 200 times sweeter than sugar (see 'Sweet Stuff', *Consumer Choice*, July 2005, p258).

Most of these sweeteners are not metabolised, but what actually happens to them in the body? Research suggests they are excreted unchanged, so this would indicate that they have no effect, although a recent Italian study has linked intense sweeteners with bladder cancer. The European Food Safety Authority has reviewed this study and deemed them safe for use.

Some consumers can have a preference for 'natural' foods. Sucralose is a sweetener from a natural source. Sucralose is derived from sugar, but making sucralose is a complex chemical process. There has been some debate as to how sucralose is marketed, as the fact that it is made from sugar is highly promoted. This can be misleading to consumers, given that there is such a degree of chemical processing of sugar to produce sucralose.

Sweeteners can also have other properties. The polyol xylitol, often used in chewing gum, has been linked with good dental health. A 2000 study in the Journal of Dental Research links xylitol with the prevention of tooth decay.

Natural sweeteners: sugar

Sugar is not as straightforward as it seems. Conventional sugar comes in many forms, and it's not just as simple as white or brown. The refined sugar we most commonly use, purified sucrose, is a combination of glucose and fructose. This sugar can be produced from refining cane sugar, or also from sugar beet. Unrefined cane sugar has become more of a speciality product and is less widely available. Other types of sugar include brown sugar, which again can be refined sugar with some molasses or even colour added to give its brown colour. It is not necessarily unprocessed. There are different types of brown sugar, like Demerara which is a light brown sugar, and muscovado which is a darker, more moist brown sugar.

Alternative natural sweeteners

There are many other natural sweeteners on the market such as honey, fructose, molasses, and syrups such as maple, wheat, rice, agave and barley.

Maple syrup comes from the North American maple tree. Agave syrup comes from a type of cactus. Other syrups, including barley, rice, and wheat, are made by extracting sugars from the grain.

Fructose is a monosaccharide or simple sugar that occurs naturally in foods like fruit, honey and vegetables. It is sweeter than refined sugar and is a slower releasing sugar in the body. Fructose in its pure form is sold as powder or crystals. This is different from high fructose corn syrup (HFSC), which is a combination of fructose and glucose now increasingly used in the soft drinks industry. The name 'high fructose' seems to suggest a high proportion of fructose but the corn syrup concentration is higher. This is a very fast releasing sugar in the body and is not a good alternative to cane sugar as it acts in a similar way in the body.

One of the problems with sweeteners is that they provide 'empty calories'. Are there sweetening substances that can satisfy our sweet tooth while also providing other health benefits?

Honey's sweet taste comes from the presence of fructose. The wider benefits of honey depend on the type of honey and there are many varieties of differing quality on the market. For example Manuka honey, which comes from the tea-tree plant, is thought to have antibacterial properties. But there are different types of Manuka honey and if you buy it for its medicinal benefits, it is important to look for 'active' Manuka honey. It is given a Unique Manuka Factor (UMF) rating from 5 to 20, with a higher rating indicating greater antibacterial activity.

Molasses is a by-product from sugar cane processing and can be used as a sweetener. Molasses also contains minerals like calcium and iron. The American Dietetic Association suggests that although some of these alternative natural sweeteners contain micro-nutrients, this is not significant enough that it should affect our sweetener choice.

Sweeteners such as honey, maple syrup and molasses are often used for their distinctive flavours as well as their sweetness.

When sugar is compared with other sweetening substances, it is not an expensive product. Table 2 lists a range of sweeteners and their prices. When choosing a sweetener, although sugar may be cheap, it is important to weigh up all considerations in relation to sweeteners, such as how they affect the body and how much we really need them. Also, some sweeteners appear very expensive, but since low-calorie sweeteners are very light and are intensely sweet, you use a lot less than if you were using sugar. Fructose is also much sweeter than sugar so a lot less can give a sweet taste.

Food labelling & sugar

When a food label states that a food has no added sugar or is sugar-free, should consumers look beyond this

TABLE 1: SWEETENERS PERMITTED FOR USE IN THE EU

Sweetener	E Number
Sorbitol	E420
Mannitol	E421
Acesulfame K	E950
Aspartame	E951
Cyclamic acid	E952
Isomalt	E953
Saccharin	E954
Sucralose	E955
Thaumatin	E957
Neohesperidine	E959
Maltitol	E965
Lactitol	E966
Xylitol	E967

seemingly positive façade? A product that is labelled sugar-free can be targeted at the diabetic market, but what does this mean for consumers who wish to avoid sugar but also not consume artificial sweeteners?

The EU directive 94/35/EC which governs the use of sweeteners in foodstuffs also covers labelling of products which contain sweeteners. Certain information is required on the label, depending on the type of sweetener used. Products containing more than 10% added polyols must be labelled 'excessive consumption may produce laxative effects' and foods containing aspartame must be labelled 'contains a source of phenylalanine'. Foods containing sweeteners must be labelled 'with sweeteners' near the name of the food. If a food label states 'with no added sugar' the food cannot contain any added monosaccharides, disaccharides, or any other foodstuffs used for their sweetening properties.

Foods with significant levels of added sugar do not have to be labelled explicitly as such, apart from in the ingredients list. Sugars can be intrinsic or extrinsic in foods. An apple will not have a label that states it contains the sugar fructose, nor milk that it contains the sugar lactose. These sugars are intrinsic in foods. Extrinsic sugars are those which are added to foods. Sugar is often hidden in foods, and we can be unaware of how much sugar we actually consume. See our recent article on breakfast cereals as an example ('Breakfast Cereals', *Consumer Choice*, June 2007, p208).

Sugars can increase blood sugar levels at a fast rate. This effect has been linked with hyperactivity in children and can also affect mood in adults, giving a sugar rush and consequent sugar low. In evaluating sugars it is important to distinguish between the long and short term effects of consumption. Some days we may crave a little something sweet but consumption of high amounts of sugar in the long term can lead to health problems.

TABLE 2: COST OF SWEETENERS

Sweetener	Size	Price (€)	Price per kilo (€)
Granulated Sugar			
Bunalun organic fairtrade	500g	1.69	3.38
Shamrock gold	1kg	2.32	2.32
Siucra	500g	0.69	1.38
Demerara			
Gem demerara	500g	0.95	1.90
Shamrock demerara	500g	1.49	2.98
Shamrock organic demerara	500g	1.83	3.66
Traidcraft unrefined demerara	500g	1.95	3.90
Muscovado			
Billingtons unrefined dark muscovado	500g	1.95	3.90
Billingtons unrefined light muscovado	500g	1.95	3.90
Shamrock dark muscovado	500g	1.62	3.24
Shamrock light muscovado	500g	1.61	3.22
Caster Sugar			
Billingtons unrefined organic caster sugar	500g	2.55	5.10
Shamrock	1kg	2.51	2.51
Siucra	1kg	1.55	1.55
Cane Sugar			
Billingtons organic granulated cane	500g	2.55	5.10
Biona organic fairtrade rapadura whole cane sugar	500g	4.25	8.50
Honey			
Boyne Valley clear	454g	2.99	6.59
Boyne Valley squeezy honey	340g	2.42	7.12
Cornvita manuka honey UMF 5+	250g	9.95	39.80
Healy's honey	454g	2.57	5.67
Molaga pure honey	360g	2.99	8.31
Tropical forest organic honey clear	454g	4.85	10.68
Fructose			
Applefords dietade fruit sugar	240g	2.40	10.00
Fruisana fruit sugar	250g	2.10	8.40
Maple syrup			
Rowse organic maple syrup	330g	4.85	14.70
Trade Winds pure maple syrup	250g	4.94	19.76
Other natural sweeteners			
Biona organic agave syrup	250g	4.99	19.96
Meridian barley malt extract	370g	1.59	4.30
Meridian molasses	740g	2.95	3.99
Meridian organic molasses	350g	1.79	5.11
Biona rice syrup	330g	3.35	10.15
Low-calorie/intense sweeteners [1]			
Canderel granular	75g	3.45	46.00
Canderel spoonful	40g	2.04	51.00
Hermesetas granular	90g	2.85	31.67
Higher nature xylosweet (xylitol)	300g	11.67	38.90
Perfect sweet xylitol	225g	4.45	19.77
Splenda granular (sucralose)	75g	3.49	46.53

Typical retail price. Prices correct as at 3 August 2007. [1] Low-calorie sweeteners weigh at lot less than other sugars. Therefore the per kilo price is very high but is not indicative of a radically more expensive product.

Report by Aisling Murtagh CC