Introduction

*Eat and drink with pleasure … and sensibly*

In our affluent society, hunger and thirst are often only secondary reasons for eating and drinking. Increasingly, we look for taste and enjoyment, even when we only have time to snatch some fast food or a snack. Today, we like to combine the basic necessities of life with conversation, a friendly atmosphere and perhaps trying out some new culinary delight.

Sweet foods have always been a temptation. Even babies respond to a sweet taste with an expression that says, “I’m happy, I like this”. In fact humans and other mammals have an innate preference for a sweet taste and, as it is a genetically determined inheritance, even the best arguments will sometimes be insufficient to persuade us not to enjoy that sweet treat. A sweet taste, moreover, has always been an instinctive criterion in selecting safe food, thereby serving the survival of the species, whilst bitter substances signal caution.

In former times, people rarely got as much energy as they actually needed. However, since the 1960’s this situation has radically changed. Today we eat more than we need and we consume too much fat and sugar, whilst complex carbohydrates and roughage form a relatively low part of our diet.

Low-calorie sweeteners are the only means of giving food a sweet taste without increasing its calorie content. Many consumers now use low-calorie sweeteners regularly to sweeten food or drinks, or they buy finished products prepared with low-calorie sweeteners.

European food law defines where and in which amounts low-calorie sweeteners may be used and how they should be labelled. A broad variety of low-calorie products is now available to those consumers who do not wish to make any compromises regarding taste while maintaining a balanced diet low on calories. Low-calorie sweeteners therefore contribute towards consumer choice.
Sweeteners: another option for sweetening

Sweeteners are the only means of giving food a sweet taste without increasing its calorie content.

At the present time, eight sweeteners are included in the European Union’s legislation for use in foods:

- acesulfame-K
- aspartame
- aspartame-acesulfame salt
- cyclamate
- neohesperidine DC
- saccharin
- sucralose
- thaumatin

Aspartame-acesulfame salt and sucralose were both evaluated by the Scientific Committee on Food (SCF) - now the European Food Safety Authority (EFSA) - in 2000 and authorised for use as a sweetener in the Sweeteners Directive 94/35/EC as amended by Directive 2003/115/EC. The latter was adopted in December 2003 and published in the Official Journal of the European Union on 29 January 2004.

Neotame, a sweetener with a sweetening power 7000-13000 times greater than sugar, is currently being evaluated by the European Food Safety Authority (EFSA).

Sweeteners should not be confused with other sugar substitutes such as, for example, sugar alcohols or "polyols", such as sorbitol, isomalt, manitol and xylitol.

Unlike sweeteners, polyols do supply energy, providing 2.4 kcal per gram. This means that they yield about half the energy of sugar (sucrose), but some are also only half as sweet. Fructose, which has the same energetic value as sugar (4 kcal per gram), is also counted as a sugar substitute.

Sweeteners and sugar substitutes have one thing in common: compared to sugar they have little (sugar substitutes) or no (sweeteners) influence on the level of insulin or blood sugar in the human body and so they are especially suitable for people with diabetes.
However, sugar substitutes have a laxative effect if consumed in large amounts whilst sweeteners cause no such problems.

**Sweetening substances at a glance**

<table>
<thead>
<tr>
<th></th>
<th>Sugar</th>
<th>Intense Sweeteners</th>
<th>Polyols</th>
<th>Fructose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy supply</strong></td>
<td>4 kcal per gram</td>
<td>virtually no kcal</td>
<td>2.4 kcal per gram</td>
<td>4 kcal per gram</td>
</tr>
<tr>
<td><strong>Relative sweetness</strong></td>
<td>1</td>
<td>30 - 3,000</td>
<td>0.4 - 1.0</td>
<td>1.2</td>
</tr>
<tr>
<td><strong>Influence on the level of insulin</strong></td>
<td>strong</td>
<td>no influence</td>
<td>weak</td>
<td>weak</td>
</tr>
<tr>
<td><strong>Influence on the digestive system</strong></td>
<td>neutral</td>
<td>no influence</td>
<td>can have a laxative effect</td>
<td>neutral</td>
</tr>
<tr>
<td><strong>Influence on dental health</strong></td>
<td>can cause caries</td>
<td>no influence</td>
<td>no influence</td>
<td>can cause caries</td>
</tr>
</tbody>
</table>

There is much to be said in favour of sweeteners

Sweeteners have been used for generations and have probably been more thoroughly tested than any other food additive. Scientific studies have proven over and over again sweeteners' positive effects and safety.

Sweet taste satisfies an innate desire. So sweeteners make it possible for those people who must or who want to reduce sugar to enjoy sweet food, thereby improving the quality of their lives. Such groups include people wanting to reduce or maintain their weight, those who wish to avoid dental caries, patients with certain metabolic disorders such as diabetes and people suffering from obesity or overweight.

The number of different sweeteners and different sweetening blends available has increased substantially over the past 25 years and consumers now have a wide choice of tastes and forms (tablets, granulateds and liquids) to choose from.
Food products containing sweeteners instead of sugar have not been adulterated. Sweeteners simply replace, in calorie-reduced products, unnecessary calories whilst important nutrients like vitamins and minerals remain intact.

Sweeteners and products containing them are not normally more expensive than their sugar-containing counterparts.

**Multiplicity of use**

Sweeteners are used in a broad range of foods and drinks. Products containing sweeteners, which can be found in the supermarkets today include:

- dairy products such as yoghurts and milk drinks
- diet soft drinks and fruit nectars
- desserts, puddings and ice-creams
- jams and marmalades
- confectionery (pastilles, candies)
- chewing gum
- fruit preserves.

Sweeteners may also be used to enhance the flavour of savoury food products such as:

- meat- and fish salads
- mayonnaise and dressings
- vegetable preserves.

**Useful at home**

Table-top sweeteners are available for individual use at home and are supplied in three different forms:

- tablet
- granulated
- liquid

One sweetener tablet normally corresponds in sweetening strength to one cube or one teaspoon of sugar. One spoonful of granulated sweetener is equal in sweetening strength to one spoonful of sugar although it weighs 10 times less and liquid sweeteners can vary between 1 drop to one teaspoon being equivalent in sweetening.
strength to one teaspoon of sugar. Tablets are convenient when sweetening hot drinks because they dissolve quickly and are packed in handy packages. Cold drinks and solid, cooked or baked foods are best prepared with a liquid or granulated sweetener.

Granulated sweetener is a special form which demonstrates the versatility of sweet alternatives. Due to their loose, fine nature, granulated sweeteners are especially suitable for sweetening fruit salads and mueslis and for sprinkling on waffles and cakes. They can also be used in cooking and baking using low calorie recipes. Their energy content is up to 90 percent lower than that of sugar. Detailed information about calorie content and instructions for correct use can be found on the packaging of every product.

Table-top sweeteners for every possible use

<table>
<thead>
<tr>
<th></th>
<th>Tablets</th>
<th>Liquid</th>
<th>Granulated sweetener</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coffee, tea</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Punch etc.</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Puddings</td>
<td></td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Hot sauces</td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>Juice, milk shakes</td>
<td></td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Cold dairy products</td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>Cake mixtures</td>
<td></td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Jams, marmalades</td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>Dressings, marinades</td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>Fresh fruit</td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>Cooking and baking</td>
<td></td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

Sweeteners can be used in many different ways, but it is true that they cannot do everything which sugar can. Due to their small mass, they do not have the binding
effect or the volume of sugar. This means that, for example, not every cake mixture will succeed if it is prepared with a sweetener instead of sugar unless the recipe is adapted. In jams and marmalades, sweeteners do not have the preserving effect of sugar, so energy-reduced products have to be kept in the refrigerator once they are opened. On the other hand, sweeteners prevent the undesired fermentation often caused by sugar in marinades and dressings.

**Sweeteners have character**

Sweeteners can be used singly or in combination with each other. Every sweetener has its own particular characteristics and, if different types of sweeteners are combined with each other, or with sugar, they can satisfy many taste requirements. Sweeteners can have synergistic effects in various sweetener combinations. So that they are sweeter than the sum of the individual sweeteners.

**Acesulfame-K**

This sweetener is calorie-free and about 200 times as sweet as sugar. Its sweetness is immediately perceptible. Acesulfame-K has a good shelf life and is heat-resistant. It can therefore be used for all normal preparations and processed foods. It has no influence on the body's metabolism and is excreted unchanged.

Acesulfame-K is very often used by the food industry in combination with other sweeteners. This develops its synergistic potential and provides a delicious taste.

**Aspartame**

Aspartame is a low-calorie sweetener approximately 200 times sweeter than sugar. It is made from two amino acids, aspartic acid and phenylalanine, two building blocks of protein. The amino acids in aspartame are found naturally in most protein-containing foods, including meats, dairy products and vegetables.

Upon digestion, aspartame breaks down to phenylalanine, aspartic acid and a small amount of the organic compound methanol. Phenylalanine is an essential amino acid. Methanol is found naturally in the body and in many foods. The level of methanol in aspartame is insignificant compared to that found in many natural foods. For example, tomato juice contains six times as much methanol as a comparable serving of a soft drink sweetened with aspartame.
Since aspartame is made up of protein constituents, it is not completely calorie-free; it contains 4 kcal per gram, like any other protein substance. However, due to its intense sweetness (about 200 times that of sugar), the amounts used are small enough for aspartame to be considered as virtually calorie-free. While one litre of sugar sweetened lemonade will contain more than 400 kcal, the corresponding amount of an aspartame-sweetened drink contains no more than 2 kcal.

The special composition of aspartame is also the reason why this sweetener slowly loses its sweetening capacity when heated up to high temperatures or stored for a long time. In such cases, aspartame is partly decomposed but remains completely safe. The substances produced are digested by the human body. However, this slight disadvantage regarding stability is balanced by the excellent taste of aspartame.

**Aspartame-acesulfame salt**

Aspartame-acesulfame salt is an intense sweetener containing aspartame and acesulfame bound to each other. On a weight basis aspartame-acesulfame salt consists of 64% aspartame and 36% acesulfame. Aspartame-acesulfame salt is approximately 350 times sweeter than sugar.

In the human body aspartame-acesulfame salt dissociates into aspartame and acesulfame. Aspartame is digested and metabolised in the body, acesulfame is not metabolised by the body, but excreted by the kidneys.

Because of its intense sweetness, the amounts used are small enough for aspartame-acesulfame salt to be considered as virtually calorie-free.

Aspartame-acesulfame salt can basically be used in applications in which aspartame and acesulfame-K are used too. It is not hygroscopic and has a very sugar-like taste.

**Cyclamate**

Cyclamate is 35 times sweeter than sugar, making it the least intensive sweetener approved for use in the European Union. However, it has long been known for its excellent taste. Cyclamate also optimises the flavour of the classic sweetener saccharin if used in the tried and tested combination of ten parts cyclamate to one part saccharin.
Cyclamate is not digested and, in the vast majority of consumers, passes through the body unchanged. In this respect it is comparable to acesulfame-K and saccharin. A very small number of people have bacteria capable of transforming cyclamate in their intestines, but even in these cases there are no adverse health implications.

Saccharin

Saccharin is the oldest and one of the strongest sweeteners on the market, possessing about 500 times the sweetening capacity of sugar. Sodium-saccharin, which is often used because it dissolves more easily, is still 450 times sweeter than sugar.

Today, saccharin is one of the most popular sweetening ingredients, used either on its own in table top products or combined with other sweeteners in low calorie foods and drinks.

Like cyclamate, saccharin is highly stable, even when frozen or heated, and it maintains its sweetness even in liquid and acidic products (such as lemonade). Given its technological characteristics and wide availability, saccharin is suitable for virtually all applications in cooking and baking, in processed and canned foods and in pharmaceutical products.

Neohesperidine DC

This calorie-free sweetener and flavour enhancer is obtained from a flavone of citrus fruits. It can be up to 1,800 as sweet as sugar but is generally only used in concentrations 400 - 600 times as sweet. When combined with other sweeteners, its sweetening capacity multiplies.

The human body absorbs only insignificant amounts of neohesperidine DC and these are digested in the same way as similar natural substances. It can suppress bitter flavours and is therefore very useful for improving the taste of pharmaceuticals like drops, syrups and effervescent tablets. When used alone, it has a lasting aftertaste similar to liquorice or menthol; combined with other sweeteners its taste is very good.

Sucralose

Sucralose is the common name for a high-intensity sweetener derived from ordinary sugar. Sucralose is 600 times sweeter than sugar and does not break down in the body.
Sucralose is non-caloric.

Sucralose has a high quality of sweetness, good water solubility and excellent stability in a wide range of processed foods and beverages. When combined with other low-calorie sweeteners, it has a synergistic sweetening effect. Like sugar, sucralose will hydrolyse in solution but unlike sugar it hydrolyses only over an extended period of time under extreme conditions of acidity and temperature.

**Thaumatin**

Thaumatin is a natural protein substance with an additional flavour-enhancing effect. As its sweetening capacity is about 2,000 - 3,000 times higher than that of sugar, its energy content (4 kcal per gram) can be regarded as negligible. It is obtained from the West African Katemfe fruit (thaumatococcus danielli).

There is a delay in the perception of the sweet flavour of thaumatin but its taste remains for longer and leaves an aftertaste similar to liquorice. When used for baking and cooking, its sweetening capacity is weakened, whilst its flavour-enhancing effects remain unchanged. Thaumatin can best be used in combination with other sweeteners.

**Relative sweetness of sweeteners**

<table>
<thead>
<tr>
<th>Sweetener</th>
<th>Relative sweetness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acesulfame-K</td>
<td>130-200</td>
</tr>
<tr>
<td>Aspartame</td>
<td>200</td>
</tr>
<tr>
<td>Cyclamate</td>
<td>30-50</td>
</tr>
<tr>
<td>Neohesperidine DC</td>
<td>400-600</td>
</tr>
<tr>
<td>Saccharin</td>
<td>300-500</td>
</tr>
<tr>
<td>Sucralose</td>
<td>600</td>
</tr>
<tr>
<td>Thaumatin</td>
<td>2,000-3,000</td>
</tr>
</tbody>
</table>
Sweeteners provide obvious benefits

In the past, sweeteners were mainly used by people with diabetes. Nowadays they are part of the normal diet. An increasing number of consumers use sweeteners because of their positive contribution to weight control and dental health.

The best-known advantages of sweeteners are that:

- they do not influence metabolism;
- they contain no (acesulfame-K, saccharin, cyclamate, sucralose) or practically no calories (aspartame, aspartame-acesulfame salt, thaumatin, neohesperidine DC)
- they do not promote tooth decay (caries).

Sweeteners play a positive role in dental health

Even if teeth cannot be brushed after every meal, sweeteners will not cause tooth decay because they are not fermented into harmful acids by oral bacteria. Under neutral conditions the mineral substances of the tooth enamel are very durable. However, all carbohydrates, which can be broken down, especially sugar and starch, are fermented into acids by the bacteria in plaque. Plaque, by the way, is also produced even when no food is consumed.

The more teeth come into contact with carbohydrates, the more active the oral bacteria become. How quickly and thoroughly the acids complete their destructive work also depends on the general condition of the teeth and on the care they receive.

Since sweeteners are free of fermentable carbohydrates, they do not reinforce the production of acids by oral bacteria. In fact, sweeteners are also used to improve the flavour of products for dental and oral hygiene, which contain fluoride, thus contributing to caries prevention. It is well known that toothpastes and mouthwashes with an agreeable taste are used more consistently and frequently than products with a "medical" taste, especially by children.

This means that sweeteners can make a substantial contribution to reducing the need for dental treatment.
Sweeteners add quality to the lives of people with diabetes

The term diabetes is used for metabolic disorders which cause an increase in the level of blood sugar because the pancreas produces either too little or no insulin. The hormone insulin maintains blood sugar on a more or less constant level. The level of blood sugar normally increases after eating, when carbohydrates are digested, broken down into their individual components (such as glucose) and transmitted into the blood stream.

In healthy bodies, when the blood sugar level increases, insulin is secreted which then contributes to the absorption of sugar from the blood into the cells. Among people suffering from diabetes, this regulating mechanism is disturbed. Their blood sugar level may vary considerably, depending on their diet, so they have to maintain a very balanced diet (and sometimes also inject insulin).

People with diabetes should have a diet rich in complex carbohydrates and fibre, since too much fat adds to their tendency to obesity and too many proteins harm their kidneys (which in any case are under more strain than those of other people). Complex carbohydrates are found in cereals and vegetables.

The importance of sweeteners in the diabetic diet is undisputed. However, recent scientific research on diabetes has concluded that people with diabetes may also consume moderate amounts of sugar. If the sugar contained in food products stays for a longer time in the stomach and intestines (as is the case, for example, of chocolate), then people with diabetes may also indulge in the enjoyment of some of these products. Such products normally also contain a high proportion of fat, however, which imposes the burden of additional calories.

Sweeteners offer people with diabetes the pleasure of a sweet taste without negative side effects. On the one hand, sweeteners have no impact on insulin and blood sugar levels and, on the other hand, they do not provide calories. Drinks, mueslis and fruit products prepared with sweeteners are ideal for people with diabetes. Moreover, low-calorie foods help this group of people, who frequently have a disposition to obesity, in the important task of controlling their weight.
Incidentally, the 33 million people with diabetes living in Europe prove that the lifelong use of sweeteners is absolutely harmless. For generations, sweeteners have been an integral part of the diet plans of this group without a single known case of sweeteners having induced any negative side effect.

**Sweeteners make weight management more palatable**

Sweeteners can be a great help to all of those seeking long-term weight control. They do not affect the appetite in any way and do not provide any calories. These are characteristics desired by many consumers with a sweet tooth but who also wish to loose or maintain their weight. Since every unused calorie enters the fat deposits of the body, the only way to lose weight is to eat less or count the calories.

Sweeteners add to a balanced diet by saving “empty” calories, which have no nutritional value. In this way, people trying to control their weight can afford to eat more of those food products, which supply the body with vital vitamins and minerals. For instance, two yoghurts prepared with a sweetener have about as many calories as one yoghurt made with sugar, but they provide double the amount of valuable nutrients.

It is not true, as is sometimes alleged, that sweeteners stimulate the appetite. Scientific studies have repeatedly shown that sweeteners do not influence the mechanisms regulating either hunger or satiety. The level of insulin and blood sugar on which they depend, does not change after the consumption of a sweetener, either directly after a meal or during the process of digestion. Sweeteners allow all those wishing to maintain, or decrease, their weight to add variety to their diet in a pleasant way without any negative side effects. However, those who have to lose weight should not use sweeteners as an excuse to eat double or triple the amount of the food they would normally consume!

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**Influence of aqueous liquids containing sweeteners on the secretion of insulin and the level of blood glucose in the human organism. A study by Härtel, Graubaum, Schneider**

**Conclusions:**
- Liquids containing sweeteners do not cause insulin secretion.
- Liquids containing sweeteners have no influence on the level of blood glucose.
- No evidence that sweeteners can cause appetite through a physiological mechanism.
Sweeteners: a rightful place in the world today.

All additives used in food products have to be approved by the regulatory authorities. The strict rule “everything that is not permitted is prohibited” is generally applied to food additives, to which sweeteners belong, according to European food law.

Approval is granted only after comprehensive scientific studies have been carried out which prove that the substance is safe for use. Such studies may take ten or more years to complete. In the European Union, the European Sweeteners Directive adopted in 1994 has harmonised the regulatory status for sweeteners. This legislation has not only facilitated the free movement of goods within Europe but has also created a basis for improved consumer information.

Consumers now have a broader variety of low-calorie products at their disposal. The directive has authorised the sweeteners acesulfame-K, aspartame, aspartame-acesulfame salt, cyclamate, neohesperidine DC, saccharin, sucralose and thaumatin for use in defined categories of food products, pertaining to energy-reduced foods and foods with no added sugar.

Clarity in labelling

In the European Union, the names and labels of all products prepared with a sweetener are obliged to conform to strict rules concerning labelling. The text on a label normally indicates "with sweetener" or, if a combination of sweeteners is used, "with sweeteners". If sugar has been used in addition to a sweetener, this is also indicated by the mention "with sugar and sweetener" or, if various substances have been combined, "with sugar and sweeteners".

The specific sweetener or sweeteners used is also found in the list of ingredients such as, for example: “Sweetener: saccharin”.

The sales description of a table-top sweetener must include the name of the particular sweetener on which it is based. The label may say for example: "saccharin-based liquid sweetener". Table-top sweeteners and food products containing aspartame additionally have to carry the statement "Contains a source of phenylalanine". This information is important for a very small group of people suffering from a rare metabolic disorder called phenylketonuria. They know that they have to be very
careful with all food products containing the protein component phenylalanine, which is also found in meat and milk.

**ADI: safety for a lifetime**

There is a defined maximum level for the consumption of every sweetener, which can be regarded as absolutely safe. This level is called the Acceptable Daily Intake (ADI). The Scientific Committee on Food (SCF) of the European Commission - now the European Food Safety Authority (EFSA) - and the Joint WHO/FAO Expert Committee on Food Additives (JECFA) determine a specific ADI for every food additive and also, therefore, for every individual sweetener, describing the amount (expressed on a body weight basis) that can be safely ingested daily over a lifetime. The ADI is calculated on the basis of long-term animal studies. Firstly the scientists determine the maximum amount of a sweetener, which has no negative influence, even if consumed daily in large amounts, over an entire lifetime. In order to ascertain the ADI, this number (= no effect level) is then divided by a high safety factor of at least one hundred. For example, if the amount guaranteed to be harmless is 100 mg per kilogram of body weight, then the ADI is set at 1mg per kilogram of body weight.

The ADI is actually a safe intake level, assuming lifelong use. The ADI does not represent a level of toxicity. Individuals may exceed the ADI occasionally, so long as their average daily intake is below the ADI. Although called an "acceptable daily intake", the ADI should always be compared with average intakes over prolonged periods, not with day-to-day intakes. In reality, consumption studies show that the ADI is hardly ever exceeded, although there would be no reason to worry about an occasional transgression, because ADI represents the quantity of a specific sweetener which can be consumed every day throughout life and which includes a safety factor of at least 100.
Reference values for carefree use

<table>
<thead>
<tr>
<th>Daily Intake</th>
<th>Acesulfame</th>
<th>Aspartame</th>
<th>Cyclamate</th>
<th>Saccharin</th>
<th>Sucralose</th>
<th>Neohesperidine</th>
<th>Thaumatin</th>
</tr>
</thead>
<tbody>
<tr>
<td>per kilo body weight in milligrams= sugar equivalent in milligrams</td>
<td><strong>9</strong></td>
<td><strong>40</strong></td>
<td><strong>7</strong></td>
<td><strong>5</strong></td>
<td><strong>15</strong></td>
<td><strong>5</strong></td>
<td>unlimited</td>
</tr>
</tbody>
</table>

1800 | 8000 | 280 | 2500 | 9000 | 3000 | 

The term "sugar equivalent" refers to the amount of sugar, which would be needed to achieve the same sweetness effect as the indicated amount of sweetener. To calculate it, refer to the table on relative sweetness of low-calorie sweeteners.

* The ADI for acesulfame-K has been set at 15 mg per kilogram of body weight by JECFA and at 9 mg per kilogram of body weight by SCF.

** The ADI for cyclamate has been set at 11mg per kilogram of body weight by JECFA and at 7 mg per kilogram of body weight by SCF.

The aspartame and acesulfame constituents in aspartame-acesulfame salt are covered by the acceptable daily intake (ADI) values previously established for aspartame and for acesulfame-K.
Sugar equivalents of intense sweeteners

(in grams of sugar per day)

<table>
<thead>
<tr>
<th></th>
<th>Acesulfame-K</th>
<th>Aspartame</th>
<th>Cyclamate</th>
<th>Saccharin</th>
<th>Neohesperidine</th>
<th>Sucralose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teenager (45 kg)</td>
<td>81</td>
<td>360</td>
<td>11</td>
<td>123</td>
<td>135</td>
<td>405</td>
</tr>
<tr>
<td>Adult woman (60 kg)</td>
<td>108</td>
<td>480</td>
<td>15</td>
<td>165</td>
<td>180</td>
<td>540</td>
</tr>
<tr>
<td>Adult man (75 kg)</td>
<td>135</td>
<td>600</td>
<td>18</td>
<td>207</td>
<td>225</td>
<td>675</td>
</tr>
</tbody>
</table>

Calculation: ADI x kg of body weight x relative sweetness of sweetener. Also see preceding page: ADI is calculated as an average over prolonged periods.

Sweeteners, in all confidence

Some nutritionists, whilst warning against the consumption of too much sugar, simultaneously advise against eating food prepared with sweeteners. They assert that these food products are the ones most "denaturalised" by industrial processing and containing the highest amounts of various additives.

Such assertions are wrong. Whether they are prepared with sugar or with sweeteners, the only difference between these products is normally their calorie content.

On this subject, the medical nutritionist Prof. Karlheinz Schmidt from Tübingen, Germany, made the following statement: "In my opinion, the main problem seems to be the assessment of the difference between "natural" and "synthetic" food products,
which does not exist in reality. It is not true that anything provided by nature is also
good for our health. If the same strict standards were applied to natural foodstuffs as
to the so-called “synthetic” substances, quite a few of them would fail to be approved
today. Sweeteners, for example, belong to the most intensively studied substances in
the world.

It does not help us in any way to condemn food additives in general and to revert time
and again to long out-dated prejudices. The resulting emotional, but nevertheless
wrong advice causes many people to miss opportunities which might otherwise have
contributed to a much-needed change in their eating habits.”

A brief history of sweeteners

The sweetener thaumatin, which has grown in importance since the Sweetener
Directive (94/35/EC) was approved by the European Union, is in fact the sweetener
known for the longest time. As far back as 1855, the British explorer Danieli, who
travelled widely through Africa, described the special sweet flavour of the West
African Katemfe fruit (thaumatococcus), which is obtained from its seed casing.

However, the title of “oldest sweetener” is generally attributed to saccharin,
discovered by chance in 1878 by Constantin Fahlberg. Twenty years later, the first
official approval was given in Germany. However in 1902, the sale of saccharin was
prohibited because, with an annual production of 175,000 kilos, it had become too
competitive for Bismarck’s government, which was at that time keen to promote the
interests of the sugar industry.

Some 50 years after the discovery of saccharin, the sweetener cyclamate was
discovered, also by chance, by the scientists Sveda and Audrieth in the laboratories of
the University of Illinois, although their original intention was to find a new medicine
to lower the body temperature. In 1950 this second sweetener was introduced on the
American market. By 1959, according to the results of research and experience, there
was every reason to include cyclamate into the “GRAS” (Generally Recognised As Safe)
list, i.e. to classify it unreservedly as a safe substance.

Ten years later a controversial discussion ensued about cyclamate. In Germany and
numerous other countries, the safety of cyclamate was fully vindicated but in the USA,
the temporary uncertainty led to the withdrawal of approval of this popular
sweetener. Subsequently, the “Cancer Assessment Committee” of the United States
Food and Drug Administration officially acquitted cyclamate of any suspicion of causing cancer as early as 1984 but we are still waiting to see when cyclamate will be approved again by the FDA.

The sweetener aspartame was discovered by the American James Schlatter in 1965. After the most comprehensive research findings ever to have been submitted for the approval of a food additive had been thoroughly examined by the regulatory authorities, aspartame was successfully launched in the USA at the beginning of the 1980’s.

Neohesperidine DC had been known since 1966 and its production method developed by George Inglett. Acesulfame-K was discovered by chance in 1967 by the scientist Karl Clauss. However, the first sweet-tasting formula found by Clauss was not acesulfame-K in its present form but a related substance. It was during comparative experiments, which are generally employed to investigate chance discoveries of this kind, that the substance with the best qualities, acesulfame-K, was subsequently developed.

Sucralose is the first sweetener to be produced from sugar. It was discovered in 1976 during a bilateral research programme.

Aspartame-acesulfame salt was discovered in 1995.

Today, sweeteners have a legitimate place in the daily diets of more than 100 million consumers in Europe alone.