[Template:About](/wiki/Template:About" \o "Template:About) [Template:Redirect2](/wiki/Template:Redirect2) [Template:Pp-semi-indef](/wiki/Template:Pp-semi-indef) [Template:Pp-move-indef](/wiki/Template:Pp-move-indef) [upright=1.5|thumb|Closeup of raw (unrefined, unbleached) sugar](/wiki/File:Raw_sugar_closeup.jpg) [Template:Good article](/wiki/Template:Good_article)

**Sugar** is the generalized name for sweet, short-chain, soluble [carbohydrates](/wiki/Carbohydrates), many of which are used in food. They are composed of carbon, hydrogen, and oxygen. There are various types of sugar derived from different sources. Simple sugars are called [monosaccharides](/wiki/Monosaccharide) and include [glucose](/wiki/Glucose) (also known as dextrose), [fructose](/wiki/Fructose), and [galactose](/wiki/Galactose). The table or granulated sugar most customarily used as food is [sucrose](/wiki/Sucrose), a [disaccharide](/wiki/Disaccharide). (In the body, sucrose hydrolyses into fructose and glucose.) Other disaccharides include [maltose](/wiki/Maltose) and [lactose](/wiki/Lactose). Longer chains of sugars are called [oligosaccharides](/wiki/Oligosaccharides). Chemically-different substances may also have a sweet taste, but are not classified as sugars. Some are used as [lower-calorie](/wiki/Low-calorie) food substitutes for sugar described as [artificial sweeteners](/wiki/Artificial_sweetener).

Sugars are found in the tissues of most plants, but are present in sufficient concentrations for efficient extraction only in [sugarcane](/wiki/Sugarcane) and [sugar beet](/wiki/Sugar_beet).[Template:Citation needed](/wiki/Template:Citation_needed) Sugarcane refers to any of several species of giant grass in the genus [*Saccharum*](/wiki/Saccharum) that have been cultivated in tropical climates in [South Asia](/wiki/South_Asia) and [Southeast Asia](/wiki/Southeast_Asia) since ancient times. A great expansion in its production took place in the 18th century with the establishment of sugar plantations in the West Indies and Americas. This was the first time that sugar became available to the common people, who had previously had to rely on honey to sweeten foods. Sugar beet, a [cultivated variety](/wiki/Cultivar) of [*Beta vulgaris*](/wiki/Beta_vulgaris), is grown as a root crop in cooler climates and became a major source of sugar in the 19th century when methods for extracting the sugar became available. Sugar production and trade have changed the course of human history in many ways, influencing the formation of colonies, the perpetuation of [slavery](/wiki/Slavery), the transition to indentured labour, the migration of peoples, wars between sugar-trade–controlling nations in the 19th century, and the ethnic composition and political structure of the [New World](/wiki/New_World).

The world produced about 168 million tonnes of sugar in 2011. The average person consumes about [Template:Convert](/wiki/Template:Convert) of sugar each year (33.1 kg in industrialised countries), equivalent to over 260 food calories per person, per day.

Since the latter part of the twentieth century, it has been questioned whether a diet high in sugars, especially refined sugars, is good for human health. Sugar has been linked to obesity, and suspected of, or fully implicated as a cause in the occurrence of diabetes, cardiovascular disease, dementia, macular degeneration, and tooth decay. Numerous studies have been undertaken to try to clarify the position, but with varying results, mainly because of the difficulty of finding populations for use as controls that do not consume or are largely free of any sugar consumption.

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## Etymology[[edit](/index.php?title=(none)&action=edit&section=1)]

[thumb|](/wiki/File:Myrmicaria_brunnea.jpg)[Ant](/wiki/Ant) feeding on sugar crystals. The [etymology](/wiki/Etymology) reflects the spread of the commodity. The [English](/wiki/English_language) word "sugar"[[1]](#cite_note-1) originates from the [Sanskrit](/wiki/Sanskrit) [Template:Lang](/wiki/Template:Lang) *śarkarā*,[[2]](#cite_note-2) via [Persian](/wiki/Persian_language) [Template:Lang](/wiki/Template:Lang) *shakkar*. It most probably came to England by way of Italian merchants. The contemporary Italian word is *zucchero*, whereas the [Spanish](/wiki/Spanish_language) and [Portuguese](/wiki/Portuguese_language) words, *azúcar* and *açúcar* respectively, have kept a trace of the [Arabic definite article](/wiki/Arabic_definite_article). The Old French word is *zuchre* – contemporary French *sucre*. The earliest [Greek](/wiki/Greek_language) word attested is σάκχαρις (*sákkʰaris*).[[3]](#cite_note-3)[[4]](#cite_note-4) A satisfactory *pedigree* explaining the spread of the word has yet to be done. The English word [*jaggery*](/wiki/Jaggery), a coarse brown sugar made from date palm sap or sugarcane juice, has a similar etymological origin; Portuguese *xagara* or *jagara*, from the Sanskrit *śarkarā*.[[5]](#cite_note-5)

## History[[edit](/index.php?title=(none)&action=edit&section=2)]

[Template:Main](/wiki/Template:Main)

### Ancient times and Middle Ages[[edit](/index.php?title=(none)&action=edit&section=3)]

[thumb|](/wiki/File:Canaviais_Sao_Paulo_01_2008_06.jpg)[Sugar cane](/wiki/Sugar_cane) plantation Sugar has been produced in the [Indian subcontinent](/wiki/Indian_subcontinent)[[6]](#cite_note-6) since ancient times. It was not plentiful or cheap in early times and [honey](/wiki/Honey) was more often used for sweetening in most parts of the world. Originally, people chewed raw sugarcane to extract its sweetness. Sugarcane was a native of tropical [South Asia](/wiki/South_Asia) and [Southeast Asia](/wiki/Southeast_Asia).<ref name=Kiple/> Different species seem to have originated from different locations with [*Saccharum barberi*](/wiki/Saccharum_barberi) originating in [India](/wiki/India) and [*S. edule*](/wiki/Saccharum_edule) and [*S. officinarum*](/wiki/Saccharum_officinarum) coming from [New Guinea](/wiki/New_Guinea).<ref name=Kiple>[Template:Cite book](/wiki/Template:Cite_book)</ref><ref name=Sharpe>[Template:Cite web](/wiki/Template:Cite_web)</ref> One of the earliest historical references to sugarcane is in Chinese manuscripts dating back to 8th century BC that state that the use of sugarcane originated in India.<ref name=gr1/>

Sugar remained relatively unimportant until the Indians discovered methods of turning [sugarcane juice](/wiki/Sugarcane_juice) into granulated crystals that were easier to store and to transport.<ref name=Adas>Adas, Michael (January 2001). *Agricultural and Pastoral Societies in Ancient and Classical History*. Temple University Press. ISBN 1-56639-832-0. Page 311.</ref> Crystallized sugar was discovered by the time of the [Imperial Guptas](/wiki/Gupta_dynasty), around the 5th century AD.<ref name=Adas/> In the local Indian language, these crystals were called *khanda* ([Devanagari](/wiki/Devanagari):खण्ड,[Template:IAST](/wiki/Template:IAST)), which is the source of the word *candy*.[[7]](#cite_note-7) Indian sailors, who carried [clarified butter](/wiki/Clarified_butter) and sugar as supplies, introduced knowledge of sugar on the various [trade routes](/wiki/Trade_routes) they travelled.<ref name=Adas/> Buddhist monks, as they travelled around, brought sugar crystallization methods to China.<ref name=Kieschnick1>Kieschnick, John (2003). *The Impact of Buddhism on Chinese Material Culture* [Princeton University Press](/wiki/Princeton_University_Press). ISBN 0-691-09676-7.</ref> During the reign of [Harsha](/wiki/Harsha) (r. 606–647) in [North India](/wiki/North_India), Indian envoys in [Tang China](/wiki/Tang_Dynasty) taught methods of cultivating sugarcane after [Emperor Taizong of Tang](/wiki/Emperor_Taizong_of_Tang) (r. 626–649) made known his interest in sugar. China then established its first sugarcane plantations in the seventh century.[[8]](#cite_note-8) Chinese documents confirm at least two missions to India, initiated in 647 AD, to obtain technology for sugar refining.<ref name=Kieschnick11>Kieschnick, John (2003). *The Impact of Buddhism on Chinese Material Culture* [Princeton University Press](/wiki/Princeton_University_Press). 258. ISBN 0-691-09676-7.</ref> In South Asia, the [Middle East](/wiki/Middle_East) and [China](/wiki/China), sugar became a staple of cooking and [desserts](/wiki/Dessert).

The triumphant progress of [Alexander the Great](/wiki/Alexander_the_Great) was halted on the banks of the [Indus River](/wiki/Indus_River) by the refusal of his troops to go further east. They saw people in the Indian subcontinent growing sugarcane and making *granulated, salt-like sweet powder*, locally called *Sharkara* ([Devanagari](/wiki/Devanagari):शर्करा,[Template:IAST](/wiki/Template:IAST)), Latin *saccharum*, Greek ζάκχαρι (zakkhari). On their return journey, the [Macedonian](/wiki/Macedonia_(ancient_kingdom)) soldiers carried the "honey-bearing reeds" home with them. Sugarcane remained a little-known crop in Europe for over a millennium, sugar a rare commodity, and traders in sugar wealthy.<ref name=gr1>[Template:Cite book](/wiki/Template:Cite_book)</ref>

[Crusaders](/wiki/Crusades) brought sugar home with them to Europe after their campaigns in the [Holy Land](/wiki/Holy_Land), where they encountered caravans carrying "sweet salt". Early in the 12th century, Venice acquired some villages near [Tyre](/wiki/Tyre,_Lebanon) and set up estates to produce sugar for export to Europe, where it supplemented honey, which had previously been the only available sweetener.[[9]](#cite_note-9)Crusade chronicler [William of Tyre](/wiki/William_of_Tyre), writing in the late 12th century, described sugar as "very necessary for the use and health of mankind".[[10]](#cite_note-10) In the 15th century, [Venice](/wiki/Venice) was the chief sugar refining and distribution centre in Europe.<ref name=gr1/>

### Modern history[[edit](/index.php?title=(none)&action=edit&section=4)]

[thumb|](/wiki/File:George_Flegel_Still-Life_with_Bread_and_Confectionary.jpg)[*Still-Life*](/wiki/Still-Life) *with Bread and Confectionery*, by [George Flegel](/wiki/George_Flegel), first half of 17th century [Template:See also](/wiki/Template:See_also) [Template:See also](/wiki/Template:See_also) In August 1492, [Christopher Columbus](/wiki/Christopher_Columbus) stopped at [La Gomera](/wiki/La_Gomera) in the [Canary Islands](/wiki/Canary_Islands), for wine and water, intending to stay only four days. He became romantically involved with the governor of the island, [Beatriz de Bobadilla y Ossorio](/wiki/Beatriz_de_Bobadilla_y_Ossorio), and stayed a month. When he finally sailed, she gave him cuttings of sugarcane, which became the first to reach the New World.[[11]](#cite_note-11) The first sugar cane harvest was conducted in Hispaniola in 1501, and many sugar mills had been constructed in Cuba and Jamaica by the 1520s.[Template:Sfn](/wiki/Template:Sfn) The Portuguese took sugar cane to Brazil. By 1540, there were 800 cane sugar mills in Santa Catarina Island and another 2,000 on the north coast of Brazil, Demarara, and Surinam.

Sugar was a luxury in Europe until the 18th century, when it became more widely available. It then became popular and by the 19th century, sugar came to be considered a necessity. This evolution of taste and demand for sugar as an essential food ingredient unleashed major economic and social changes.<ref name=mintz>[Template:Cite book](/wiki/Template:Cite_book)</ref> It drove, in part, colonization of tropical islands and nations where labor-intensive sugarcane plantations and sugar manufacturing could thrive. The demand for cheap labor to perform the hard work involved in its cultivation and processing increased the demand for the slave trade from Africa (in particular West Africa). After slavery was abolished, there was high demand for [indentured laborers](/wiki/Indentured_labor) from South Asia (in particular India).<ref name=britain1>[Template:Cite web](/wiki/Template:Cite_web)</ref>[[12]](#cite_note-12)[[13]](#cite_note-13) Millions of slave and indentured laborers were brought into the Caribbean and the Americas, Indian Ocean colonies, southeast Asia, Pacific Islands, and East Africa and Natal. The modern ethnic mix of many nations that have been settled in the last two centuries has been influenced by the demand for sugar.[[14]](#cite_note-14)[[15]](#cite_note-15)[[16]](#cite_note-16) Sugar also led to some industrialization of areas where sugar cane was grown. For example, Lieutenant J. Paterson, of the Bengal establishment, persuaded the British Government that sugar cane could be cultivated in British India with many advantages and at less expense than in the West Indies; as a result, sugar factories were established in [Bihar](/wiki/Bihar) in eastern India.[[17]](#cite_note-17) During the [Napoleonic Wars](/wiki/Napoleonic_Wars), sugar beet production increased in continental Europe because of the difficulty of importing sugar when shipping was subject to [blockade](/wiki/Blockade). By 1880, the sugar beet was the main source of sugar in Europe. It was cultivated in Lincolnshire and other parts of England, although the United Kingdom continued to import the main part of its sugar from its colonies.[[18]](#cite_note-18) Until the late nineteenth century, sugar was purchased in [loaves](/wiki/Sugarloaf), which had to be cut using implements called [Sugar nips](/wiki/Sugar_nips).[[19]](#cite_note-19) In later years, granulated sugar was more usually sold in bags.

Sugar cubes were produced in the nineteenth century. The first inventor of a process to make sugar in cube form was the [Moravian](/wiki/Moravia) [Jakub Kryštof Rad](/wiki/Jakub_Kryštof_Rad), director of a sugar company in [Dačice](/wiki/Dačice). He began sugar cube production after being granted a five-year patent for the process on January 23, 1843. [Henry Tate](/wiki/Henry_Tate) of [Tate & Lyle](/wiki/Tate_&_Lyle) was another early manufacturer of sugar cubes at his refineries in Liverpool and London. Tate purchased a patent for sugar cube manufacture from German [Eugen Langen](/wiki/Eugen_Langen), who in 1872 had invented a different method of processing of sugar cubes.[[20]](#cite_note-20)

## Chemistry[[edit](/index.php?title=(none)&action=edit&section=5)]

[frame|](/wiki/File:Saccharose.svg)[Sucrose](/wiki/Sucrose): a disaccharide of [glucose](/wiki/Glucose) (left) and [fructose](/wiki/Fructose) (right), important molecules in the body. [Template:Nutritionalvalue](/wiki/Template:Nutritionalvalue) [Template:Nutritionalvalue](/wiki/Template:Nutritionalvalue) [Template:Main](/wiki/Template:Main) Scientifically, *sugar* loosely refers to a number of carbohydrates, such as monosaccharides, disaccharides, or [oligosaccharides](/wiki/Oligosaccharide). Monosaccharides are also called "simple sugars," the most important being glucose. Almost all sugars have the formula [Template:Chem](/wiki/Template:Chem) (n is between 3 and 7). [Glucose](/wiki/Glucose) has the [molecular formula](/wiki/Molecular_formula) [Template:Chem](/wiki/Template:Chem). The names of typical sugars end with -*ose*, as in "[glucose](/wiki/Glucose)" and "[fructose](/wiki/Fructose)". Sometimes such words may also refer to any types of [carbohydrates](/wiki/Carbohydrates) soluble in [water](/wiki/Water). The [acyclic](/wiki/Open-chain_compound) mono- and disaccharides contain either [aldehyde](/wiki/Aldehyde) groups or [ketone](/wiki/Ketone) groups. These [carbon-oxygen](/wiki/Carbonyl) double bonds (C=O) are the reactive centers. All saccharides with more than one ring in their structure result from two or more monosaccharides joined by [glycosidic bonds](/wiki/Glycosidic_bond) with the resultant loss of a molecule of water ([Template:Chem](/wiki/Template:Chem)) per bond.<ref name=Pigman>[Template:Cite book](/wiki/Template:Cite_book)</ref>

Monosaccharides in a closed-chain form can form glycosidic bonds with other monosaccharides, creating disaccharides (such as sucrose) and polysaccharides (such as [starch](/wiki/Starch)). [Enzymes](/wiki/Enzymes) must hydrolyze or otherwise break these glycosidic bonds before such compounds become [metabolized](/wiki/Metabolism). After digestion and absorption the principal monosaccharides present in the blood and internal tissues include glucose, fructose, and galactose. Many pentoses and hexoses can form [ring structures](/wiki/Heterocyclic_compound). In these closed-chain forms, the aldehyde or ketone group remains non-free, so many of the reactions typical of these groups cannot occur. Glucose in solution exists mostly in the ring form at [equilibrium](/wiki/Chemical_equilibrium), with less than 0.1% of the molecules in the open-chain form.<ref name=Pigman/>

### Natural polymers of sugars[[edit](/index.php?title=(none)&action=edit&section=6)]

[Biopolymers](/wiki/Biopolymer) of sugars are common in nature. Through photosynthesis, plants produce [glyceraldehyde-3-phosphate](/wiki/Glyceraldehyde-3-phosphate) (G3P), a phosphated 3-carbon sugar that is used by the cell to make monosaccharides such as glucose ([Template:Chem](/wiki/Template:Chem)) or (as in cane and beet) sucrose ([Template:Chem](/wiki/Template:Chem)). Monosaccharides may be further converted into [structural polysaccharides](/wiki/Polysaccharides#structural_polysaccharides) such as [cellulose](/wiki/Cellulose) and [pectin](/wiki/Pectin) for [cell wall](/wiki/Cell_wall) construction or into energy reserves in the form of [storage polysaccharides](/wiki/Polysaccharides#storage_polysaccharides) such as starch or [inulin](/wiki/Inulin). Starch, consisting of two different polymers of glucose, is a readily degradable form of chemical [energy](/wiki/Potential_energy) stored by [cells](/wiki/Cell_(biology)), and can be converted to other types of energy.<ref name=Pigman/> Another polymer of glucose is cellulose, which is a linear chain composed of several hundred or thousand glucose units. It is used by plants as a structural component in their cell walls. Humans can digest cellulose only to a very limited extent, though [ruminants](/wiki/Ruminant) can do so with the help of [symbiotic](/wiki/Symbiosis) bacteria in their gut.[[21]](#cite_note-21) [DNA](/wiki/DNA) and [RNA](/wiki/RNA) are built up of the monosaccharides [deoxyribose](/wiki/Deoxyribose) and [ribose](/wiki/Ribose), respectively. Deoxyribose has the formula [Template:Chem](/wiki/Template:Chem) and ribose the formula [Template:Chem](/wiki/Template:Chem).[[22]](#cite_note-22)

### Flammability[[edit](/index.php?title=(none)&action=edit&section=7)]

Because sugars burn easily when exposed to flame, the handling of sugars risks [dust explosion](/wiki/Dust_explosion). The [2008 Georgia sugar refinery explosion](/wiki/2008_Georgia_sugar_refinery_explosion), which killed 14 persons and injured 40, and destroyed most of the refinery, was caused by the ignition of sugar dust. [right|thumb|upright=1.4|Magnification of grains of refined](/wiki/File:Sugar_2xmacro.jpg) [sucrose](/wiki/Sucrose), the most common free sugar.

## Types of sugar[[edit](/index.php?title=(none)&action=edit&section=8)]

### Monosaccharides[[edit](/index.php?title=(none)&action=edit&section=9)]

Fructose, galactose, and glucose are all simple sugars, [monosaccharides](/wiki/Monosaccharide), with the general formula C6H12O6. They have five hydroxyl groups (−OH) and a carbonyl group (C=O) and are cyclic when dissolved in water. They each exist as several [isomers](/wiki/Isomer) with dextro- and laevo-rotatory forms that cause polarized light to diverge to the right or the left.<ref name=Manual>[Template:Cite book](/wiki/Template:Cite_book)</ref>

* [**Fructose**](/wiki/Fructose), or fruit sugar, occurs naturally in fruits, some root vegetables, cane sugar and honey and is the sweetest of the sugars. It is one of the components of sucrose or table sugar. It is used as a [high-fructose syrup](/wiki/High-fructose_corn_syrup), which is manufactured from hydrolyzed corn starch that has been processed to yield [corn syrup](/wiki/Corn_syrup), with enzymes then added to convert part of the glucose into fructose.[[23]](#cite_note-23)\*In general, [**galactose**](/wiki/Galactose) does not occur in the free state but is a constituent with glucose of the disaccharide [lactose](/wiki/Lactose) or milk sugar. It is less sweet than glucose. It is a component of the antigens found on the surface of [red blood cells](/wiki/Red_blood_cell) that determine [blood groups](/wiki/ABO_blood_group_system).[[24]](#cite_note-24)\*[**Glucose**](/wiki/Glucose), dextrose or grape sugar, occurs naturally in fruits and plant juices and is the primary product of [photosynthesis](/wiki/Photosynthesis). Most ingested carbohydrates are converted into glucose during digestion and it is the form of sugar that is transported around the bodies of animals in the bloodstream. It can be manufactured from starch by the addition of enzymes or in the presence of acids. Glucose syrup is a liquid form of glucose that is widely used in the manufacture of foodstuffs. It can be manufactured from starch by [enzymatic hydrolysis](/wiki/Enzymatic_hydrolysis).[[25]](#cite_note-25)

### Disaccharides[[edit](/index.php?title=(none)&action=edit&section=10)]

Lactose, maltose, and sucrose are all compound sugars, [disaccharides](/wiki/Disaccharide), with the general formula C12H22O11. They are formed by the combination of two monosaccharide molecules with the exclusion of a molecule of water.<ref name=Manual/>

* [**Lactose**](/wiki/Lactose) is the naturally occurring sugar found in milk. A molecule of lactose is formed by the combination of a molecule of galactose with a molecule of glucose. It is broken down when consumed into its constituent parts by the enzyme [lactase](/wiki/Lactase) during digestion. Children have this enzyme but some adults no longer form it and they are unable to digest lactose.[[26]](#cite_note-26)\*[**Maltose**](/wiki/Maltose) is formed during the germination of certain grains, the most notable being [barley](/wiki/Barley), which is converted into [malt](/wiki/Malt), the source of the sugar's name. A molecule of maltose is formed by the combination of two molecules of glucose. It is less sweet than glucose, fructose or sucrose.<ref name=Manual/> It is formed in the body during the digestion of starch by the enzyme [amylase](/wiki/Amylase) and is itself broken down during digestion by the enzyme [maltase](/wiki/Maltase).[[27]](#cite_note-27)\*[**Sucrose**](/wiki/Sucrose) is found in the stems of sugarcane and roots of sugar beet. It also occurs naturally alongside fructose and glucose in other plants, in particular fruits and some roots such as carrots. The different proportions of sugars found in these foods determines the range of sweetness experienced when eating them.<ref name=Manual/> A molecule of sucrose is formed by the combination of a molecule of glucose with a molecule of fructose. After being eaten, sucrose is split into its constituent parts during digestion by a number of enzymes known as [sucrases](/wiki/Sucrase).[[28]](#cite_note-28)

## Sources[[edit](/index.php?title=(none)&action=edit&section=11)]

The sugar contents of common fruits and vegetables are presented in Table 1. All data with a unit of g (gram) are based on 100 g of a food item. The fructose/glucose ratio is calculated by dividing the sum of free fructose plus half sucrose by the sum of free glucose plus half sucrose.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Table 1. Sugar content of selected common plant foods (g/100g)[[29]](#cite_note-29) | | | | | | | |
| **Food item** | **Total carbohydrate**[**Template:Ref**](/wiki/Template:Ref) **including "**[**dietary fibre**](/wiki/Dietary_fibre)**"** | **Total sugars** | **Free fructose** | **Free glucose** | **Sucrose** | **Fructose/ Glucose ratio** | **Sucrose as a % of total sugars** |
| ***Fruits*** |  |  |  |  |  |  |  |
| Apple | 13.8 | 10.4 | 5.9 | 2.4 | 2.1 | 2.0 | 19.9 |
| Apricot | 11.1 | 9.2 | 0.9 | 2.4 | 5.9 | 0.7 | 63.5 |
| Banana | 22.8 | 12.2 | 4.9 | 5.0 | 2.4 | 1.0 | 20.0 |
| Fig, dried | 63.9 | 47.9 | 22.9 | 24.8 | 0.9 | 0.93 | 0.15 |
| Grapes | 18.1 | 15.5 | 8.1 | 7.2 | 0.2 | 1.1 | 1 |
| Navel orange | 12.5 | 8.5 | 2.25 | 2.0 | 4.3 | 1.1 | 50.4 |
| Peach | 9.5 | 8.4 | 1.5 | 2.0 | 4.8 | 0.9 | 56.7 |
| Pear | 15.5 | 9.8 | 6.2 | 2.8 | 0.8 | 2.1 | 8.0 |
| Pineapple | 13.1 | 9.9 | 2.1 | 1.7 | 6.0 | 1.1 | 60.8 |
| Plum | 11.4 | 9.9 | 3.1 | 5.1 | 1.6 | 0.66 | 16.2 |
| ***Vegetables*** |  |  |  |  |  |  |  |
| Beet, red | 9.6 | 6.8 | 0.1 | 0.1 | 6.5 | 1.0 | 96.2 |
| Carrot | 9.6 | 4.7 | 0.6 | 0.6 | 3.6 | 1.0 | 77 |
| Corn, sweet | 19.0 | 6.2 | 1.9 | 3.4 | 0.9 | 0.61 | 15.0 |
| Red pepper, sweet | 6.0 | 4.2 | 2.3 | 1.9 | 0.0 | 1.2 | 0.0 |
| Onion, sweet | 7.6 | 5.0 | 2.0 | 2.3 | 0.7 | 0.9 | 14.3 |
| Sweet potato | 20.1 | 4.2 | 0.7 | 1.0 | 2.5 | 0.9 | 60.3 |
| Yam | 27.9 | 0.5 | tr | tr | tr | na | tr |
| Sugar cane |  | 13 - 18 | 0.2 – 1.0 | 0.2 – 1.0 | 11 - 16 | 1.0 | high |
| Sugar beet |  | 17 - 18 | 0.1 – 0.5 | 0.1 – 0.5 | 16 - 17 | 1.0 | high |

[Template:Note](/wiki/Template:Note) The carbohydrate figure is calculated in the USDA database and does not always correspond to the sum of the sugars, the starch, and the "dietary fibre".

## Production[[edit](/index.php?title=(none)&action=edit&section=12)]

[Template:See also](/wiki/Template:See_also)

### Sugar beet[[edit](/index.php?title=(none)&action=edit&section=13)]

[thumb|upright|A pack of sugar made of sugar beet.](/wiki/File:Packed_sugar_Slutsk.jpg) [Sugar beet](/wiki/Sugar_beet) (*Beta vulgaris*) is a [biennial plant](/wiki/Biennial_plant)[[30]](#cite_note-30) in the [Family](/wiki/Family_(biology)) [Amaranthaceae](/wiki/Amaranthaceae), the tuberous root of which contains a high proportion of sucrose. It is cultivated in temperate regions with adequate rainfall and requires a fertile soil. The crop is harvested mechanically in the autumn and the crown of leaves and excess soil removed. The roots do not deteriorate rapidly and may be left in a clamp in the field for some weeks before being transported to the processing plant. Here the crop is washed and sliced and the sugar extracted by diffusion. [Milk of lime](/wiki/Milk_of_lime) is added to the raw juice and [carbonatated](/wiki/Carbonatation) in a number of stages in order to purify it. Water is evaporated by boiling the syrup under a vacuum. The syrup is then cooled and seeded with sugar crystals. The white sugar that crystallizes out can be separated in a centrifuge and dried. It requires no further refining.[[31]](#cite_note-31)

### Sugarcane[[edit](/index.php?title=(none)&action=edit&section=14)]

Sugarcane (*Saccharum spp.*) is a [perennial](/wiki/Perennial_plant) grass in the family [Poaceae](/wiki/Poaceae). It is cultivated in tropical and sub-tropical regions for the sucrose that is found in its stems. It requires a frost-free climate with sufficient rainfall during the growing season to make full use of the plant's great growth potential. The crop is harvested mechanically or by hand, chopped into lengths and conveyed rapidly to the processing plant. Here, it is either milled and the juice extracted with water or extracted by diffusion. The juice is then clarified with [lime](/wiki/Calcium_hydroxide) and heated to kill [enzymes](/wiki/Enzyme). The resulting thin syrup is concentrated in a series of evaporators, after which further water is removed by evaporation in vacuum containers. The resulting [supersaturated](/wiki/Supersaturation) solution is seeded with sugar crystals and the sugar crystallizes out and is separated from the fluid and dried. [Molasses](/wiki/Molasses) is a by-product of the process and the fiber from the stems, known as [bagasse](/wiki/Bagasse), is burned to provide energy for the sugar extraction process. The crystals of raw sugar have a sticky brown coating and either can be used as they are or can be bleached by [sulfur dioxide](/wiki/Sulfur_dioxide) or can be treated in a [carbonatation](/wiki/Carbonatation) process to produce a whiter product.[[32]](#cite_note-32) About [Template:Convert](/wiki/Template:Convert) of irrigation water is needed for every one kilogram of sugar produced.[[33]](#cite_note-33)